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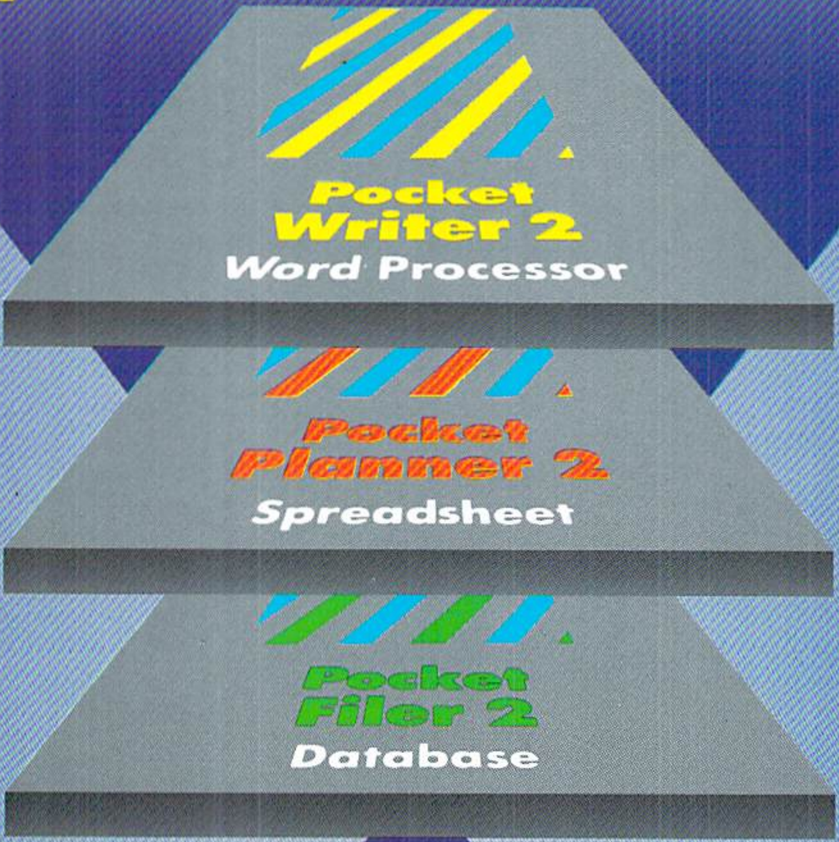
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*Commodore's Micro-computers Magazine, independent reviewers, rated the original Pocket Writer 128/64 and Pocket Planner 128/64 software the "Annual Best of 1986" in the productivity category.

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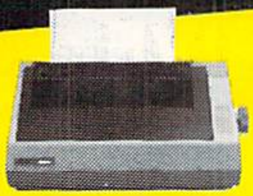
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VIEW FROM THE BRIDGE

Once upon a time in the home computer world, companies took turns releasing the Ultimate Machine. One manufacturer's pride and joy would barely reach the shelves before a more powerful, more cost-efficient, or otherwise superior rival would be announced.

Then came the Amiga 1000. We spent the following year and a half waiting for it to be eclipsed. It didn't happen.

But–what a great country this is. To preserve the competitive spirit of the microcomputer marketplace, Commodore has surpassed its own creation!

While we saw the Amiga 2000 at a closed-door presentation in Commodore's New York offices in December, we were bound to silence until after the machine's late February release date. But as of this issue, the story can be told–and is told in graphic detail by Morton Kevelson, beginning on page 53.

You can't buy an Amiga 2000 yet–but there's plenty in this issue of *Ahoy!* to keep you busy on your 64 and 128 until you can:

• What a dirty trick Dale Rupert's been playing on us these past three years. We thought we were just learning programming from the *Rupert Report,* and having a whale of a time doing it. But it recently dawned on us that the sneak has been reteaching us all the high school and college math we forgot, and many new concepts besides. The painless learning process continues this month with a lesson on *Fractals,* along with a program for creating recursively generated curves. (Turn to page 20.)

• Making good on his promise to cover a great deal besides COMAL in our new column devoted to the language, Richard Herring discusses *Turtle Graphics, COMAL, and Logo* this month. (Turn to page 77.)

• When Cleveland Blakemore told us he was working on his first productivity program for *Ahoy!*, we began counting the days. We knew that if he programmed it to the same exacting standards as *Vault of Terror, The Last Ninja*, and other classic games, the result would be too amazing to picture. As it turned out, Cleve provided the pictures–with *Infoflow*, an icon-driven database for the C-128. (Turn to page 37.)

• But in embarking on a second programming career, Cleve has not deserted his specialty. This issue also features *Planet Duel,* a two-player space battle in BASIC 7.0. (Turn to page 34.)

• If the bags of gold distributed throughout Tony Brantner's latest game don't turn you into a *Scrambler,* the laser-firing robot sentries will! (Turn to page 34.)

• Shawn K. Smith's *List Formatter* rearranges crunched C-128 code into a more readable format without sacrificing speed. (Turn to page 85.)

• Bob Blackmer dishes up *Pieman*, requiring you to cope in the best Lucy Ricardo tradition with a conveyor belt gone bonkers. (Turn to page 15.)

• James C. Hilty's *Laps* whips you around a 3-D track as you and another player compete for entry in the Ion International 500. (Turn to page 63.)

• R. Harold Droid places the VIC chip's *Extended Background Mode*–not supported by BASIC 7.0–at the disposal of C-128 programmers. (Turn to page 82.)

• Our *Entertainment Software Section* takes a patriotic turn this month with *Commodoring for the Cup,* profiling the new America's Cup yacht racing simulations from Electronic Arts and Mindscape, and *New Baseball Games in Town,* running down this season's additions to the national pastime. Also featured are full-length looks at *Video Vegas, Howard the Duck,* and *Titanic: The Recovery Mission.* (Turn to page 41.)

• As usual, *Tips Ahoy!* provides a cream of the crop cross section of the hundreds of programming and hardware hints we receive each month (turn to page 72); *Commodares* offers several evenings' worth of intellectual delight or living hell–depending on your perspective (turn to page 86); and *Scuttlebutt* capsulizes the most current prerelease information on software, peripherals, and other items for Commodore users. (Turn to page 8.)

There's more waiting for you inside. And we'll be waiting to hear what you think. —*David Allikas*

Reader Service No. 150

SCUTTLEBUTT

AMIGA MUSIC • NEW PRINTERS • C-128 DESIGN • SUPPORT FOR MSD DRIVE, B-128 • MIDI SEQUENCER • GAMES FROM MICROPROSE, INFOCOM, ACTIVISION • LESSON PLANNER • CABLES FOR PLUS/4, 128 • 1200 BAUD MODEM • COMMODORE PERIPHERALS AND 128D

COMMODORE PERIPHERALS

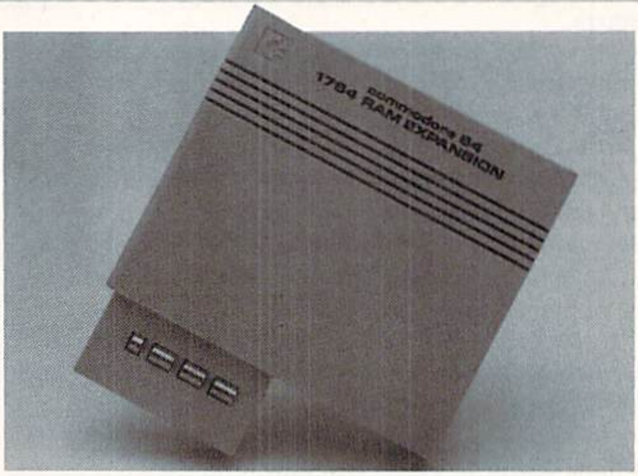
While the biggest news to come out of Commodore this month is detailed beginning on page 53 of this issue, three new peripherals were showcased at January's Consumer Electronics Show:

• The Commodore 1581 3.5" Disk Drive ($399) provides C-64, C-128, Plus/4, and C-16 users with faster data transfer (three times that of the 1541), and greater storage capacity (808K). (Another advantage of 3½" disks is of course the protection afforded by their hard shells—until you have to shell out for them.)

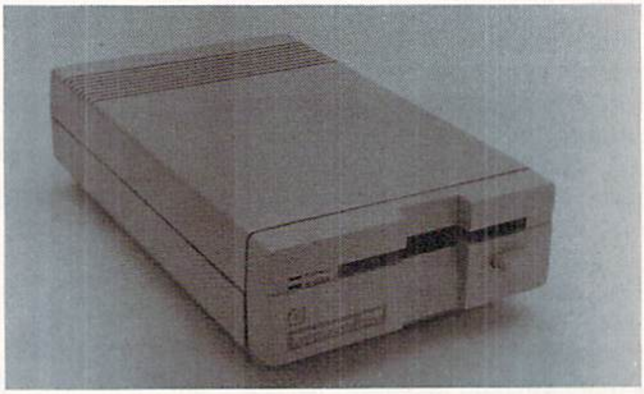
• The 1764 RAM Expansion ($129) plugs into the expansion port of a C-64 to add 256K of memory. Included are two RAM disk programs, one for use with GEOS and one without, for utilizing the RAM module as a pseudo-disk drive for instantaneous loading and saving of programs.

• The Commodore 1351 Mouse ($49.00) for the 64 or 128 offers a choice of joystick or proportional operating mode, the latter providing for a faster, more responsive onscreen pointer.

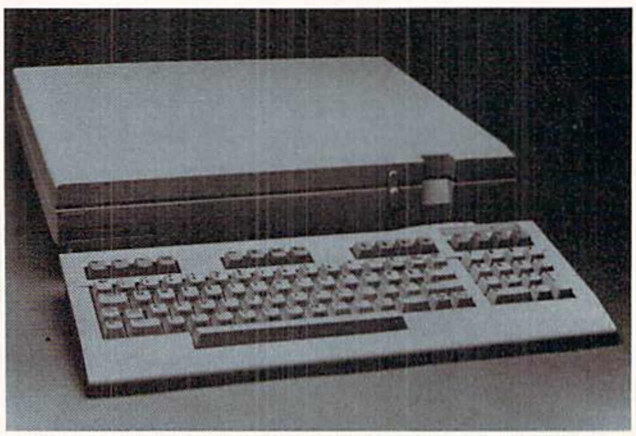
Commodore Business Machines, Inc., 215-431-9100 (see address list, page 14).



Commodore's 1764 RAM Expander increases the capacity of the C-64 to five times its unexpanded size, adding 256K RAM. READER SERVICE NO. 157



The Commodore 1581 3.5" disk drive has a data transfer rate three times that of the 1541, and over 800K storage capacity per disk. READER SERVICE NO. 158



The 128D sports an in-console disk drive and a detached keyboard. But despite the new configuration, it is 100% C-128 compatible. READER SERVICE NO. 159

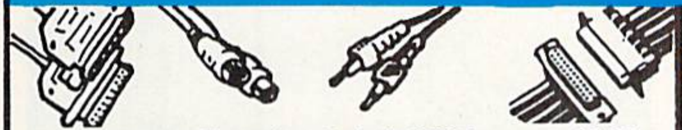
128D AND PC CLONES

Commodore also announced the release in the United States of three machines previously available in the rest of the world:

• While 100% C-128 compatible, the 128D ($550) features IBM AT-like styling with an in-console disk drive and a detachable keyboard. The main benefit is the unit's smaller footprint, with additional space saved by placement of the monitor on top of the CPU.

• The PC10-1 ($999) and PC10-2 ($1199), differing only in the number of included floppy drives, each feature IBM compatibility and built-in serial and parallel ports and monochrome/color display cards.

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C-64/128 AND AMIGA GAMES

The Augusta and Pinehurst courses are included on Access Software's *Famous Courses of the World* ($19.95), for use with *Leader Board* for the C-64. Each hole reproduces the distance, traps, water hazards, and rough of these courses.

Access Software, 801-298-9077 (see address list, page 14).

Tom Clancy's "Red Storm Rising" will be adapted for MicroProse by Sid Meier *(F-15 Strike Eagle, Silent Service)* sometime in late 1987. The game will be the first of a possible series based on the million-selling novel.

MicroProse, 301-771-1151 (see address list, page 14).

Five C-64 arcade entertainments from Mindscape, each $29.95:

Uridium pits you against a squadron of Super-Dreadnought ships aiming to deplete your galactic sector's mineral resources.



Commodore's PC10-1 and dual drive PC10-2 (pictured) are IBM clones featuring built-in parallel and serial ports and monochrome/color display cards. READER SERVICE NO. 160

Trailblazer lets one or two players race soccer balls through networks of changing color grids on a split screen. 20 fixed courses and a random course are included.

Parallax puts you and four other astronauts on an alien planet, where you must thwart an imminent attack on Earth.

Uchi Mata lets martial artists practice all the major judo throws while competing against another player or the computer.

FIST: The Legend Continues pits players against Ninja assassins, shoguns, warriors, mercenaries, and panthers on over 100 puzzle- and trap-filled screens.

Mindscape, Inc., 312-480-7667 (see address list, page 14).

The first release in Activision's Solid Gold series, featuring two old standards in one package for under $15, will be *Pitfall!* and *Demon Attack.*

Activision, Inc., 415-960-0410 (see address list, page 14).

New from Infocom:

Hollywood Hijinx worthy of the worst "B" movies are what you'll be dragged into as you search the sprawling Malibu home of your deceased movie mogul uncle for the ten treasures hidden there. If you find them all in one night, the shooting match is yours. For the 64 ($34.95) and Amiga ($39.95).

Douglas Adams' *Bureaucracy* entangles the gamer in miles of red tape, starting with a bank's refusal to acknowledge your change-of-address form and leading, just as you'd expect, to a tree in the Zalagasan jungle (among other places).

Zork I, II, and *III* are now available in a single package as *The Zork Trilogy.* For the C-64; $59.95.

Infocom and science museums throughout North America are hosting a series of marathon gaming sessions for high school students, with the first team to solve the designated text adventure winning a personal computer for its school. None were scheduled far enough in advance for



Gridiron! ***utilizes 500K of Amiga memory to combine realistic strategy with fast action.*** ***READER SERVICE NO. 161***

us to report on here, but a call to Infocom will procure you the latest dates and locations.

Infocom, Inc., 617-492-6000 (see address list, page 14).

The 500K *Gridiron!* ($69.95) lets Amiga users set 11 individual player characteristics, including the speed and strength of offensive and defensive players, and control the action as it occurs in real time. All players move according to instructions across a detailed playing field, accompanied by digital audio sound effects recorded at a live game. Plays may be taken straight from the playbook (consisting of 20 offense and 20 defense) or modified.

Bethesda Softworks, 301-469-7061 (see address list, page 14).

From Electronic Arts:

As an agent of an organization known only as The Foundation, the Amiga user seeks to *Return to Atlantis* ($49.95) by completing 14 underwater missions in various international locales. The two-disk graphic adventure contains over 40,000 words of text.

Co-authored by one of baseball's winningest managers, *Earl Weaver Baseball* for the Amiga ($49.95) lets the skipper set lineups, trade and draft players, design his own ballpark, and assemble an all-star team. Special TV effects like slow motion, freeze frame, and instant replay make for more realistic gameplay. Earl's advice is available in the program for consultation on key decisions.

The *PHM Pegasus* combat simulation for the 64 ($39.95) puts players in control of a hydrofoil missile craft as they battle enemy vessels in eight water war assignments.

50% larger in code size and more challenging than its predecessor, *The Bard's Tale II: The Destiny Knight* ($39.95) centers around the C-64 gamer's attempt to find and reassemble the fragments of the Destiny Wand and restore the Realm to peace and prosperity. (Additionally, the original *Bard's Tale* has been released in an enhanced Amiga version for $49.95.)

EA has launched its new Amazing Software line of under-$20 games for the teen male market with *Dan Dare: Pilot of the Future,* described as "the first interactive comic book." Each C-64 screen becomes a comic book panel that the user controls, with captions, 3-D graphics, mazes, puzzles, fist fights, and a soundtrack.

Finally, the following new addi-

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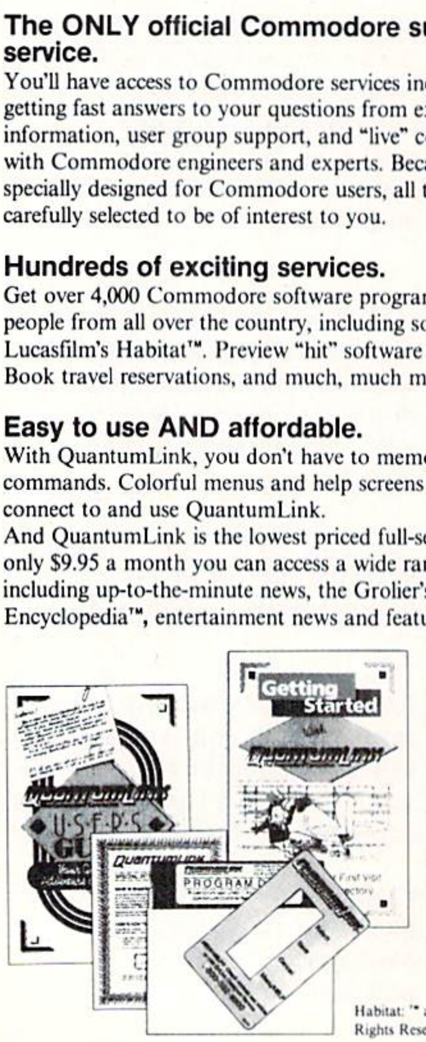
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tions to EA's line of repackaged, under-$15 Software Classics, some of which we can remember bouncing on our knee mere months ago: *Archon II: Adept, Skyfox, Ultimate Wizard, Movie Maker, Financial Cookbook,* and *Mind Mirror.*

Electronic Arts, 415-960-0410 (see address list, page 14).

THE B-128 LIVES

For sheer shock value, we thought we'd never top last month's announcement of new software for the PET 8032, put to sleep years ago by Commodore. But we're able to do it easily this issue with the announcement of the Chicago B-128 Users Group International. The organization is dedicated to the support of the computer that Commodore itself supported for only a few weeks following its release in 1983, before withdrawing it in favor of the C-64. Actually in operation for over a year, CBUG has made available working co-processors, hi-res boards, and previously shelved software, along with publishing a quarterly newsletter of over 80 pages. B-128 owners should contact the group for information.

Chicago B-128 Users Group, 414-743-4151 (see addres list, page 14).

MSD DRIVE SUPPORT

On the subject of adopting orphans, David W. Martin has written and published *The MSD DOS Reference Guide* for owners of MSD single and dual drives (no longer being manufactured). Provided are commented RAM and source code ROM memory maps, plus a number of program listings. Price is $20 for the book, $6 for a program disk, and $3 shipping (Canada $30, $8, and $7).

David W. Martin (see address list, page 14).

The MSD Information Exchange provides public domain software, a newsletter, and other materials to readers who send self-addressed envelopes or disks with self-addressed mailers. Contact Paul E. Eckler for details.

MSD Information Exchange (see address list, page 14).

C-128 DESIGN PROGRAM

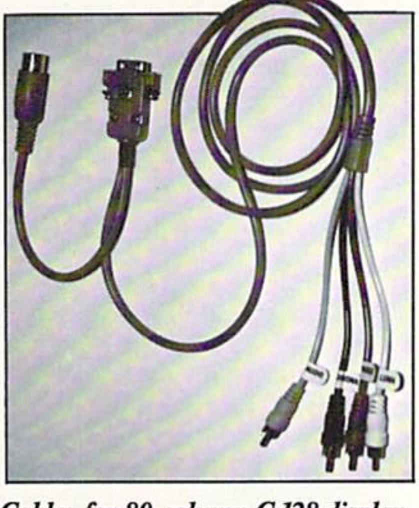
A drawing program designed for the C-128 incorporating the 1750 512K RAM option, *T.H.I.S.* (Technological Highbred Integrated System) includes 100% tracking in all graphic modes, four drawing screens, seven font styles, a 48K print buffer, and many other features. It can be had with light pen ($159) or without ($59).

Micro Aided Designs, 714-680-5179 (see address list, page 14).

INCA LINKER

Two cables made for the C-128 by INCA permit monochrome 80 column displays on any composite monitor with RCA jacks. The 80 Column Mono Cable for the Commodore 1701 and 1702 monitors has a switch for toggling between 40 and 80 columns. The 40/80 Column Switch Cable is for all other monitors with RCA jacks, also with a toggle. (Neither cable is intended for use with RGB monitors such as the Commodore 1902, or with any standard TV set.)

INCA, 619-224-1177 (see address list, page 14).



Cables for 80-column C-128 display.
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AMIGA DISK MANAGER

CLI-Mate ($34.95) makes it possible to perform Amiga disk operations without using the CLI or *Workbench.* Users can rename and delete files, make directories, create multiple file copies, adjust page length, margins,

and page numbers, and produce screen or printed output in HEX or ASCII format. A view utility permits the accessing, viewing, and copying of IFF formatted pictures.

Progressive Peripherals & Software, 303-825-4144 (see address list, page 14).

FREE SPIRIT'S FIFTH

The latest in the series, *Music of the Masters V* includes over 50 themes from popular classical works, such as Beethoven's Fifth, the Blue Danube, and March of the Toreadors. Price of the C-64 disk is $9.95; or all five volumes can be purchased for $38.95 (shipping free).

Free Spirit Software, 312-352-7323 (see address list, page 14).

DEEP END SOFTWARE

Swimming Pool Chemistry Database for the C-128 ($19.95) calculates the required doses of pool chemicals and maintains test and treatment records. The programs will conduct cost and consumption analysis, and record any maintenance action and its costs.

Free Spirit Software, Inc., 312-352-7323 (see address list, page 14).

PRINTER OUTPUT

Epson has reduced list prices on four of its dot matrix printers: the LQ-800 (to $699 from $799), the LQ-1000 (to $995 from $1095), the LX-86 (to $299 from $349), and the EX-800 (to $649 from $749).

Epson America, Inc., 213-539-9140 (see address list, page 14).

The Seikosha SP-1200AI ($319) prints at 120 cps in draft and 25 cps in NLQ mode, at a noise level under 52 dBA. Features include removable tractor unit and automatic single sheet loading.

Seikosha America Inc., 201-529-4655 (see address list, page 14).

Continued on page 114

Companies Mentioned in Scuttlebutt

Access Software, Inc.
2561 South 1560 West
Woods Cross, UT 84087
Phone: 801-298-9077

Activision, Inc.
2350 Bayshore Parkway
Mountain View, CA 94043
Phone: 415-960-0410

Bethesda Softworks
9208 Burning Tree Road
Bethesda, MD 20817
Phone: 301-469-7061

Chicago B-128 Users Group
1723 Michigan
Sturgeon Bay, WI 54235
Phone: 414-743-4151

Commodore Business Machines, Inc.
1200 Wilson Drive
West Chester, PA 19380
Phone: 215-431-9100

Electronic Arts
1820 Gateway Drive
San Mateo, CA 94404
Phone: 415-571-7171

Epson America, Inc.
2780 Lomita Boulevard
Torrance, CA 90505
Phone: 213-539-9140

Free Spirit Software
538 S. Edgewood
LaGrange, IL 60525
Phone: 312-352-7323

INCA
1249 Downing Street
P.O. Box 789
Imperial Beach, CA 92032
Phone: 619-224-1177

Infocom, Inc.
125 CambridgePark Drive
Cambridge, MA 02140
Phone: 617-492-6000

MSD Information Exchange
2705 Hulman Street
Terre Haute, IN 47803

Micro Aided Designs
1311 South Highland Drive
Fullerton, CA 92632
Phone: 714-680-5179

MicroProse
120 Lakefront Drive
Hunt Valley, MD 21030
Phone: 301-771-1151

Mindscape Inc.
3444 Dundee Road
Northbrook, IL 60062
Phone: 312-480-7667

Passport Designs Inc.
625 Miramontes Street
Half Moon Bay, CA 94019
Phone: 415-726-0280

R.M. Harris
P.O. Box 12303
Fort Wayne, IN 46863

Seikosha America Inc.
1111 Macarthur Boulevard
Mahwah, NJ 07430
Phone: 201-529-4655

Small Systems Software
150 Chapman Drive
Wellsburg, WV 26070
Phone: 304-737-2891

Timeworks, Inc.
444 Lake Cook Road
Deerfield, IL 60015
Phone: 312-948-9200

Trans Com, Inc.
703-13 Annoreno Drive
Addison, IL 60101
Phone: 312-543-9055

PIEMAN

For the C-64

By Bob Blackmer

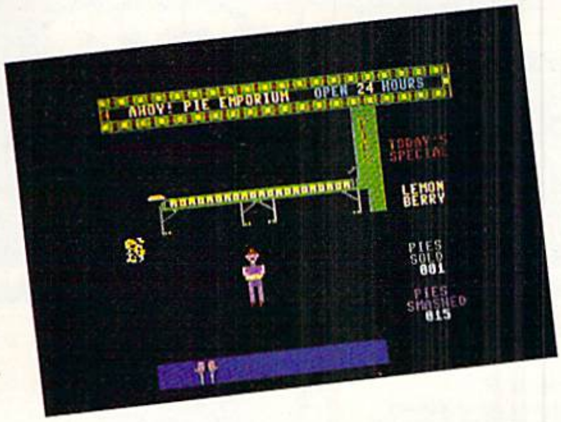


PHOTO: MICHAEL R. DAVILA

Needing to make a little extra cash, you are elated to hear about an opening at the *Ahoy!* Pie Emporium as a counterman. After an interview with the manager, he agrees to hire you. You listen attentively as he describes your duties, which consist of taking pies off the conveyor line and giving them to the waiting customers. You say to yourself, "This job is a piece of cake!" After serving several customers and brimming with confidence, you begin to sense that the piemaking machine is running a little fast. Not having the experience to service the machine, you do your best as some of the pies begin to hit the floor....

Pieman is a colorful arcade game for the C-64 written in machine language. The object of the game is to serve all the customers that show up at the *Ahoy!* Pie Emporium.

To take a pie, position yourself so you can see your hands above the conveyor line and when a pie goes by, press the fire button of a joystick plugged in Port 2. You will now have a pie, which you take to the service counter. When you are in front of the customer, press the fire button and you will make a sale. After you have sold a number of pies, the conveyor will speed up. At this point, some pies will begin to land on the floor. When you have ruined 30 pies, the *Ahoy!* Pie Emporium will close to clean up and hire a new counterman. How many pies can you sell?

Pieman must be entered using *Flankspeed* (see page 87). After typing in and saving *Pieman*, reset the computer and LOAD "PIEMAN",8,1. Then SYS 49152 to start. ☐

SEE PROGRAM LISTING ON PAGE 94

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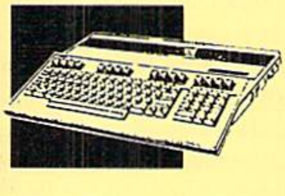
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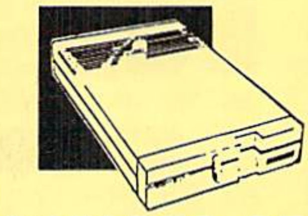
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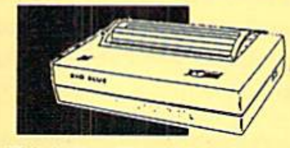


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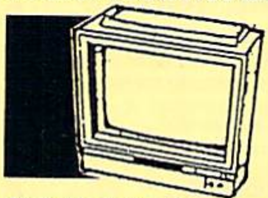
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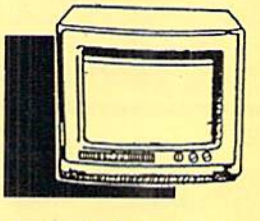


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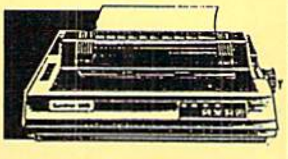


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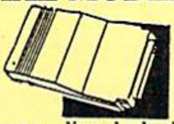
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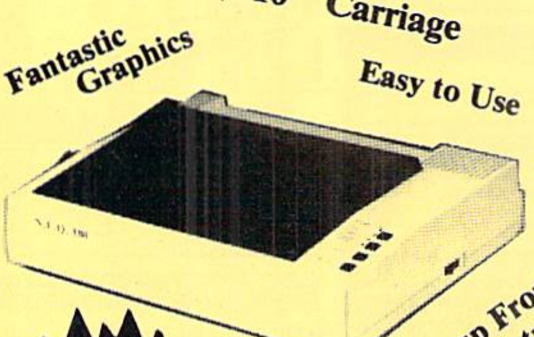
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Interface
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Paper
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Printing Method
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Fractals are paradoxical in nature. Fractals are the most complicated geometrical structures imaginable. On the other hand, they may be created by repeatedly applying very simple rules.

The mathematical concepts involving fractals have been studied since the early 1900's. It is only recently with the advent of high-powered computers and graphics displays that these geometric marvels have become front-page news.

This month we will look at one type of fractal construction, recursively generated curves. We will develop a program for the C-128 to show various stages of fractal creation. The techniques will be applicable to other computers, but they must provide a line-drawing routine to implement the program.

BEAUTY IN REPETITION

To create a fractal curve, start with a line segment called the "initiator." To this initiator apply some rule called the "generator." The generator will generally break the initiator into smaller segments of various orientations. The next step of fractal generation is to apply the generator rule to each of the small segments created by the first application. This process is repeated as desired (or until computer memory or graphics resolution are exceeded).

The initiator and the first two applications of a generator are shown in Figure 1. The initiator for our purposes is a horizontal line segment starting at the point (0,0). We are using standard cartesian-coordinate notation. The first number of the pair is the X or horizontal position. The second number is the Y or vertical position.

The generator in this example subdivides the initiator horizontally into thirds, so we will think of the initiator as extending from (0,0) to (3,0). This generator consists of four segments as shown in Figure 1B. The segments go from point (0,0) to (1,0), from (1,0) to (2,1), from (2,1) to (2,0), and from (2,0) to (3,0).

In words, this generator on a horizontal initiator may be described as "right one unit, up and right one unit, down one unit, right one unit." "Right" means in the positive x direction, and "up" means in the positive y direction. The generator always starts at (0,0), the left-hand point of the initiator, and it must eventually end up at the right-hand point of the initiator.

The generator in Figure 1B is the Level 1 fractal curve. To create the Level 2 curve, apply the generator rules to each of the four segments in the Level 1 curve. Simply divide each of the segments in Figure 1B into thirds and construct a miniature of the Level 1 curve on each segment. The results are shown in Figure 1C.

The terms "right" and "up" are not exactly appropriate for a segment which is not horizontal from left to right. However, for such segments, just rotate the segment until it is horizontal, then apply the generator rules, and finally rotate it back.

BRING ON THE SOFTWARE

Level 1 and Level 2 curves can readily be drawn by hand. Beyond the Level 2 curve, the use of pencil and paper becomes tedious and error-prone indeed. To the rescue comes the personal computer with its wonderful graphics capabilities. The program *Fractal Maker* on page 110 provides a general-purpose fractal generating tool.

The program is written for the C-128. To implement it on the C-64 would require the addition of a high resolution line-drawing statement. A DRAW or LINE statement is available in some of the advanced BASICs for the C-64. (For the really ambitious, the September '84 and August '85 *Rupert Reports* present line drawing and high resolution plotting routines which could be adapted for this purpose.)

This program displays a menu from which any one of nine fractal generators may be chosen. The descriptions of the generators are stored in DATA statements beginning at line 10000. The main loop of the program is contained in lines 100 through 800. It consists of six primary functions. We will discuss each one.

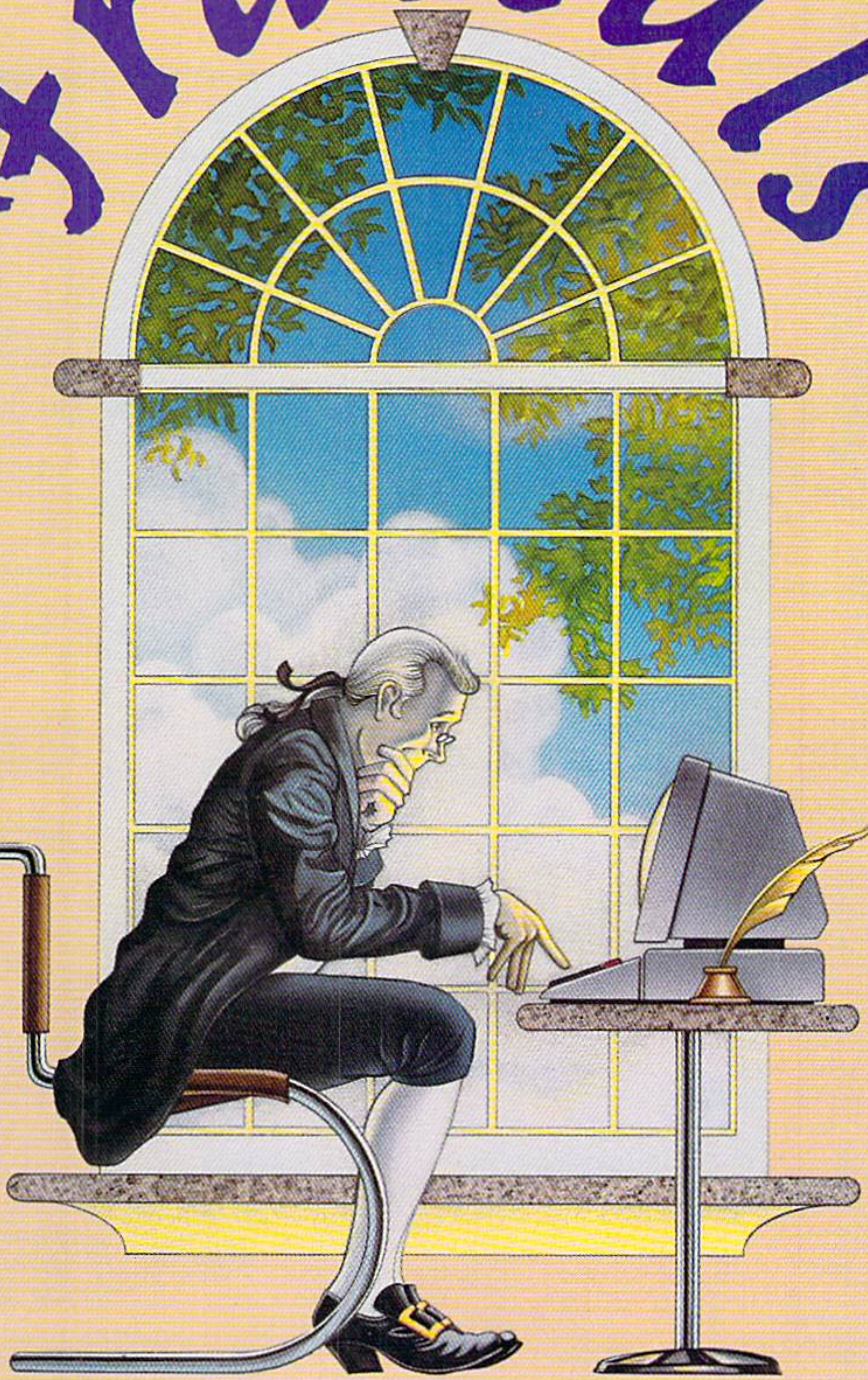
The menu routine starts at line 9000. As written, it allows only nine choices. The number of choices is contained in NUMSEL in line 9110. To expand the menu to more choices would require additional logic or else the use of the INPUT statement instead of the GETKEY statement in line 9140. With GETKEY, the RETURN key is not pressed to make a selection.

Line 9170 does the heavy work in this routine. It calculates a line number DL corresponding to a DATA statement belonging to the selected fractal generator. The RESTORE DL statement sets the READ-DATA pointer to the selected line. Consequently, the line numbers beginning at 10000 must not be changed. The data section for fractal number one starts at line 10100. Fractal numbers two and three start at 10200 and 10300, and so forth. We will discuss the data structure shortly.

The second routine in the main loop is the initialization beginning at line 2000. This routine reads the first two data values N and R pointed to by the menu routine. These are the numbers of segments in the generator (N) and of horizontal subdivisions (R) of the initiator.

For our example in Figure 1 above, N would be 4 and R would be 3. The initialization routine dimensions the necessary arrays depending upon the total number of seg-

Fractals



Geometric Intricacies

By Dale Rupert

ILLUSTRATION: JOSIE YEE

ments which will be drawn at the highest level. The amount of memory and the number of segments in the generator determine the maximum number of levels which can be displayed.

WINDOW DRESSING

The third main-loop routine sets up a split-screen, high resolution graphics mode with two lines of text at the bottom of the screen. This routine also initializes the graphics window constants so that images of various sizes can be scaled to fill the screen. (The details of this routine are presented in the September '86 *Rupert Report: Windows, Viewports, and a Moebius Strip.)*

The coordinates of the graphics window are read in line 3060. Each fractal has a window size given for it. The four numbers are WL, WR, WB, and WT corresponding to the left, right, bottom, and top coordinates of the window through which the fractal image is viewed.

Some explanation is in order. For the fractal in Figure 1, the left-most point has a horizontal (X) value of 0 and the right-most point has an X value of 3. To make the curve go completely across the screen, we would set WL and WR to 0 and 3 respectively. The vertical size of the fractal can be estimated by looking at the Level 2 curve in Figure 1C. The lowest vertical (Y) value is 0, and the curve doesn't extend above a Y value of 1. So we could specify 0 and 1 for WB and WT respectively.

These numbers are not critical. If we chose −0.5 and 1.5 for WB and WT, the fractal would not fill the screen vertically. There would be some blank screen above and below the image. These window values mean that the screen will show all points with vertical values ranging from −0.5 up to 1.5. There is a blank border since our image extends only from 0 up to 1 vertically. These numbers can be chosen to change the X to Y aspect ratio of the screen so that a one-by-one object is really square on the screen.

If the range of the window values is too small, the image will be crunched wherever it hits the window border. It is better to choose a window which is too large rather than too small. The whole image can be seen (although perhaps shrunken) in a large window, although it will be distorted at the edges by a small window.

To aid in creating your own fractals, the program keeps track of the minimum and maximum X and Y values actually plotted in the image. Those values are presented to you after the last level fractal has been displayed. You may use those numbers in the DATA statements for WL, WR, WB, and WT if you want the highest level fractal to completely fill the screen.

Generally it is best to set WB slightly below the lowest Y value of the fractal, since the two lines of text at the bottom of the split screen cover up part of the graphics image.

THE GENERATOR

The routine at line 4000 reads the remaining data for the selected fractal. These values are the X,Y pairs for the coordinates of each of the midpoints in the generator. Note that there must be N−1 pairs of values where N is the number of line segments in the generator (specified in the first DATA statement). The generator data pairs do not include the starting point 0,0. Also the data values do not include the ending point. The ending point will always be R,0 where R is the number of horizontal subdivisions specified in the first DATA statement.

For the example in Figure 1, there would be three pairs of data values: (1,0), (2,1), and (2,0). The left and right endpoints (0,0) and (3,0) must not be listed. Consequently the DATA statements for Figure 1 would be:

```
10100 REM - FIGURE 1 EXAMPLE
10120 DATA 4,3
10140 DATA 0,3,0,1
10160 DATA 1,0, 2,1, 2,0
```

To display this fractal, we must replace one of the nine sets of data. Here we have arbitrarily replaced the first set. (Before entering this new data, you might manually renumber lines 10100 - 10160 to 20100 - 20160 for example. That way you won't need to retype the data if you want the original fractal back.)

As a brief summary of the data structure, line 10120 gives the number of segments (N) and the horizontal width (R) of the generator. Line 10140 gives the left, right, bottom, and top values for the screen window (WL, WR,

WB, WT) dependent upon the size of the fractal. Line 10160 lists the N−1 pairs of midpoints of the generator in order, not including the two endpoints.

The generator routine assigns the endpoint values in lines 4020 and 4030. It reads the midpoint values and scales them to the horizontal range of 0 to 1 in lines 4050 to 4080. The loop in lines 4090 through 4140 calculates the horizontal and vertical distances (deltas) between consecutive points and stores them in the DX and DY arrays.

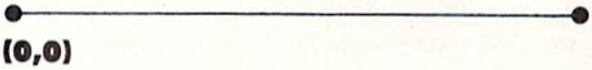


Figure 1A—Initiator

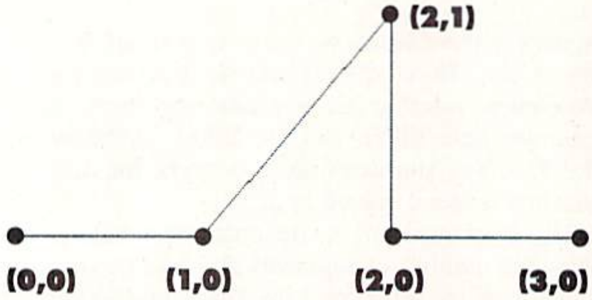


Figure 1B—Generator (Level 1)

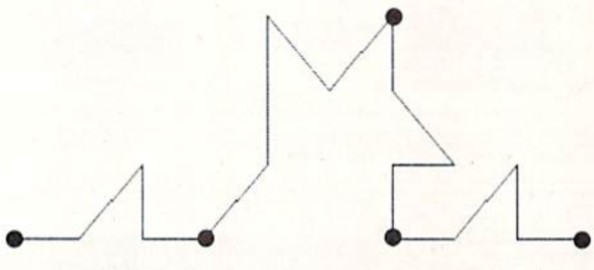


Figure 1C—Level 2 Fractal

READY TO DRAW

After all this preparation, the routine beginning at line 5000 is ready to begin calculating, storing, and drawing each level of the specified curve. The X and Y arrays store the coordinates of each point drawn.

The amount of available memory determines the number of levels which can be drawn. The REMarks should help figure out the operation of this part of the program. We will use our example from Figure 1 to provide a cursory description of the program flow sequence.

Assume the maximum number of levels (ML) to be plotted is three. (This is just an example; it is not the actual number which would be calculated in line 2020.) The number of segments (N) in the generator is 4. Line 2030 calculates the number of points in the final (level 3) curve to be 64, not including the initial point (0,0). The arrays X and Y have been dimensioned to contain elements from 0 to 64 apiece.

The left endpoint is in X(0), Y(0). The right endpoint is in X(64), Y(64). The three midpoints of the generator are evenly spaced throughout the array. The first midpoint is stored in element 16 (X(16) and Y(16)). The other midpoints are in elements 32 and 48. These values are calculated and stored as the Level 1 curve is drawn.

The next level of the routine takes each consecutive pair of those Level 1 points, subdivides the segments between them, and calculates the three new midpoints for each of those segments. There will be 16 segments in Level 2.

These new points fit into the X and Y arrays between the points already there. For example, the three midpoints of the first segment are stored in elements 4, 8, and 12. Now the first segment is defined by elements 0 through 16 in steps of 4 of the X and Y arrays.

The third and final level subdivides each of the 16 segments into 4 more subsegments, giving a total of 64 segments. Since this is the highest level to be drawn, these new segment midpoints are stored in adjacent array locations, and the array is full.

For each segment at any given level, there are N−1 new subsegments to be determined. The loop at line 5120 steps through each segment from the previous level, and the loop at line 5220 calculates the N−1 new subsegment endpoints for each of those segments.

The program pauses at the end of each level. Press any key to proceed to the next level. Once the last level is displayed, a key press returns to the text screen where the actual displayed minimum and maximum values are listed. You may record these and modify the window coordinates in the DATA statements if the image is not properly filling the screen.

If you press any key during the calculation of a level, the computer asks whether you want to continue with that level or return to the menu. It may take a moment for the program to recognize your keystroke, since, for execution speed, the keyboard is checked only after each segment is complete.

The technical details of the program are quite involved. The operation of the program is quite straightforward. If you understand the structure of the DATA statements, you may easily create your own fractal generators. Reading about the program is nowhere near as enjoyable as running it.

PROGRAM INTRICACIES

Here are a few technical aspects of the *Fractal Maker* program. Line 9 was a last minute addition to make up for a BASIC 7.0 bug. The first time the program was run after booting, it would stop with a "?SYNTAX ERROR IN 5020" error. Upon running it again, everything worked fine. It turns out that if the DEF FN in line 50 occurs before the high-resolution graphics screen is established

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in line 3010, the first application of the defined function causes the syntax error. The solution is simply to define the graphics screen (set aside the memory block) before defining the function.

To see this error, delete line 9. Type GRAPHIC CLR to deallocate graphics memory space, then type RUN. After you choose a menu item, the program halts with the syntax error. Replace line 9, or just run the program again, and everything is fine.

Line 10 represents another very interesting aspect of BASIC 7.0. Line 10 branches to a block of statements which simply defines all of the scalar (non-dimensioned) variables. The program runs *much* more slowly for the initialization and first level if the scalar variables are not all defined before the arrays are dimensioned. Evidently if any new scalar variables are defined after the arrays are dimensioned, the arrays are "moved around" in memory. With 6000-element arrays, this moving around takes an appreciable amount of time.

For example, when NP is 4096, (X and Y arrays are dimensioned to 4096 each in line 2050), the time in jiffies for the main routines at lines 2000, 3000, and 4000 are as follows:

Routine at line . . .	With Line 10	Without Line 10
2000	44 jiffies	42 jiffies
3000	29 jiffies	2058 jiffies
4000	54 jiffies	306 jiffies

The routine at 2000 did not vary much since the arrays were not dimensioned until the end of that routine. (It is not clear why it took longer with line 10 in place.) The whopping difference of over 30 seconds for the routine at line 3000 is certainly proof of the significance of this rule:

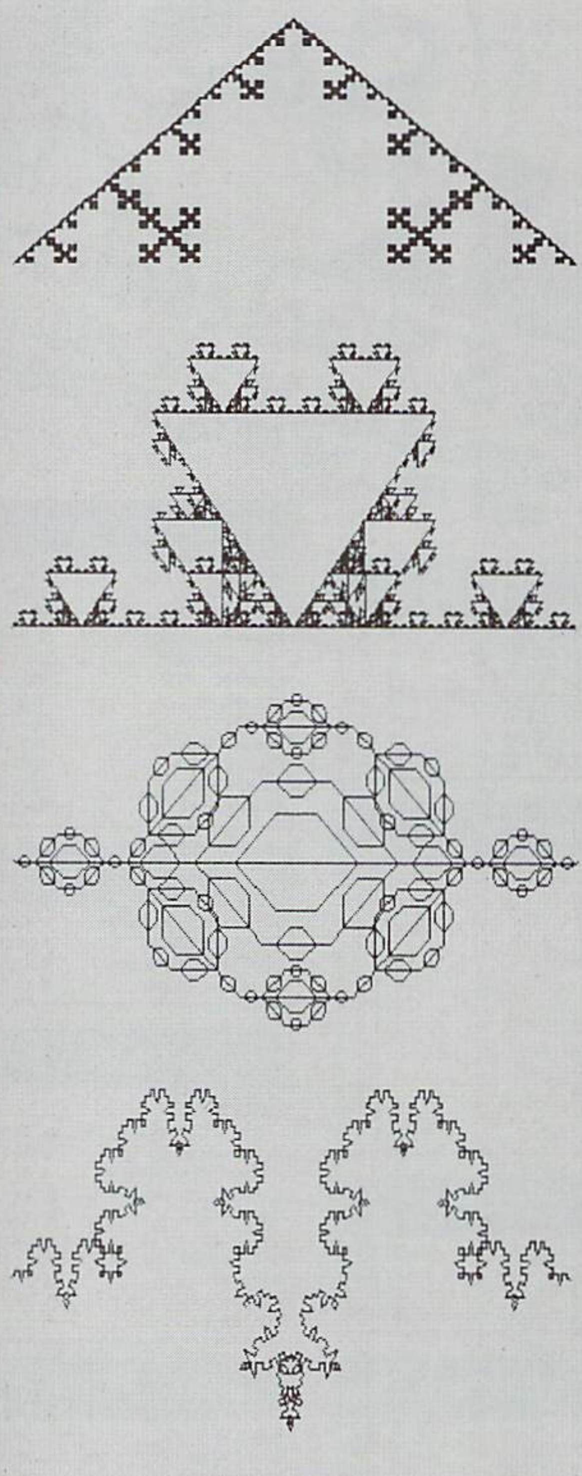
> For programs using large arrays, define all non-dimensioned variables *before* dimensioning the arrays.

The order in which variables are defined can also affect program execution speed. Define the most frequently used variables first. First in the list at line 8010 are the variables contained within the inner loop between lines 5230 and 5350, since this is the most-utilized code segment.

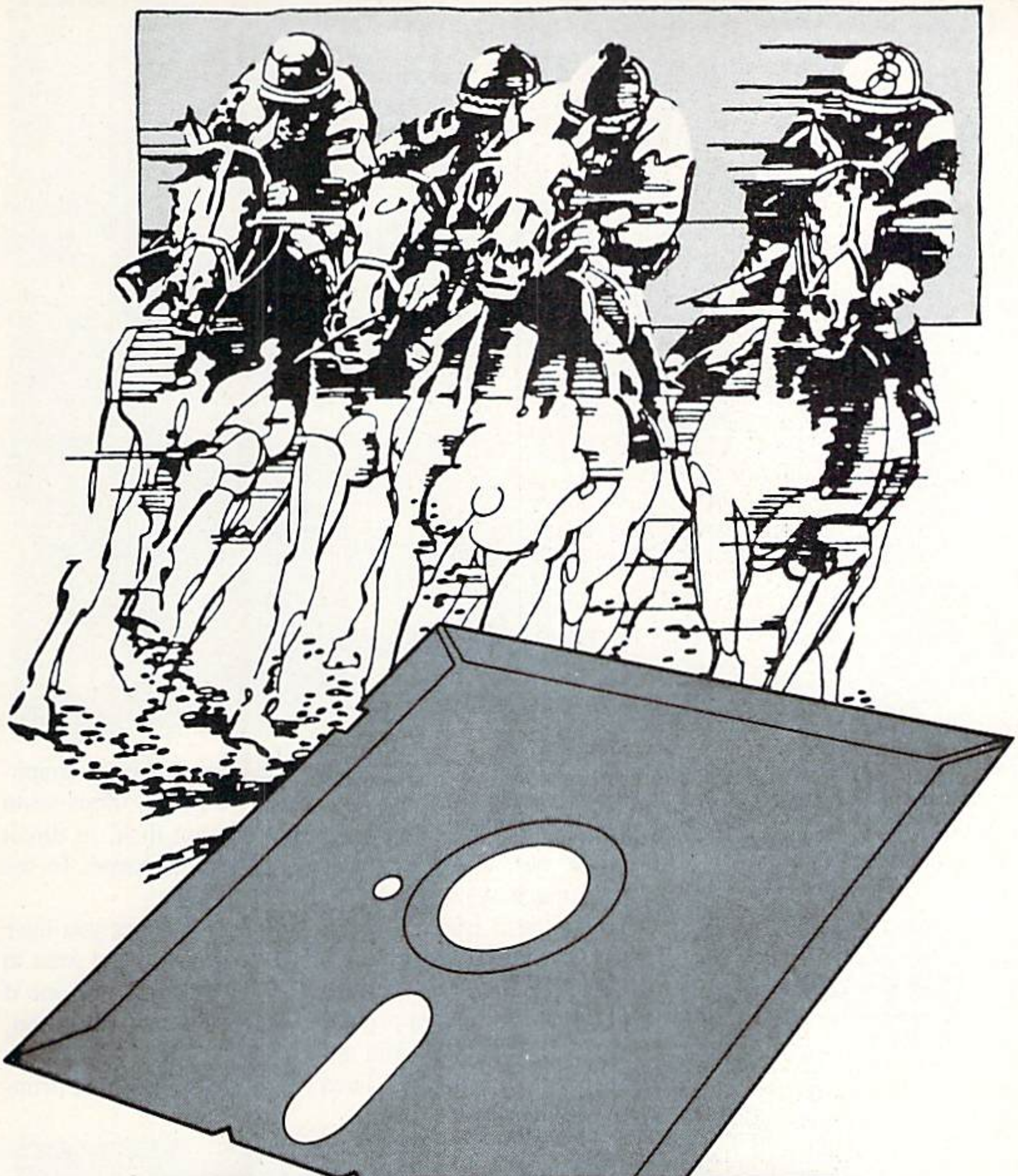
There are other ways you could improve the speed of this program. By combining several statements into one line and by removing the REMs at the ends of lines, you may find a measurable improvement. (Leave the REMs at the beginnings of lines since they are referenced by other parts of the program.) Only the statements in the main loop starting at line 5000 as well as the subroutines called by that loop will significantly affect execution times. Don't bother compressing the other portions.

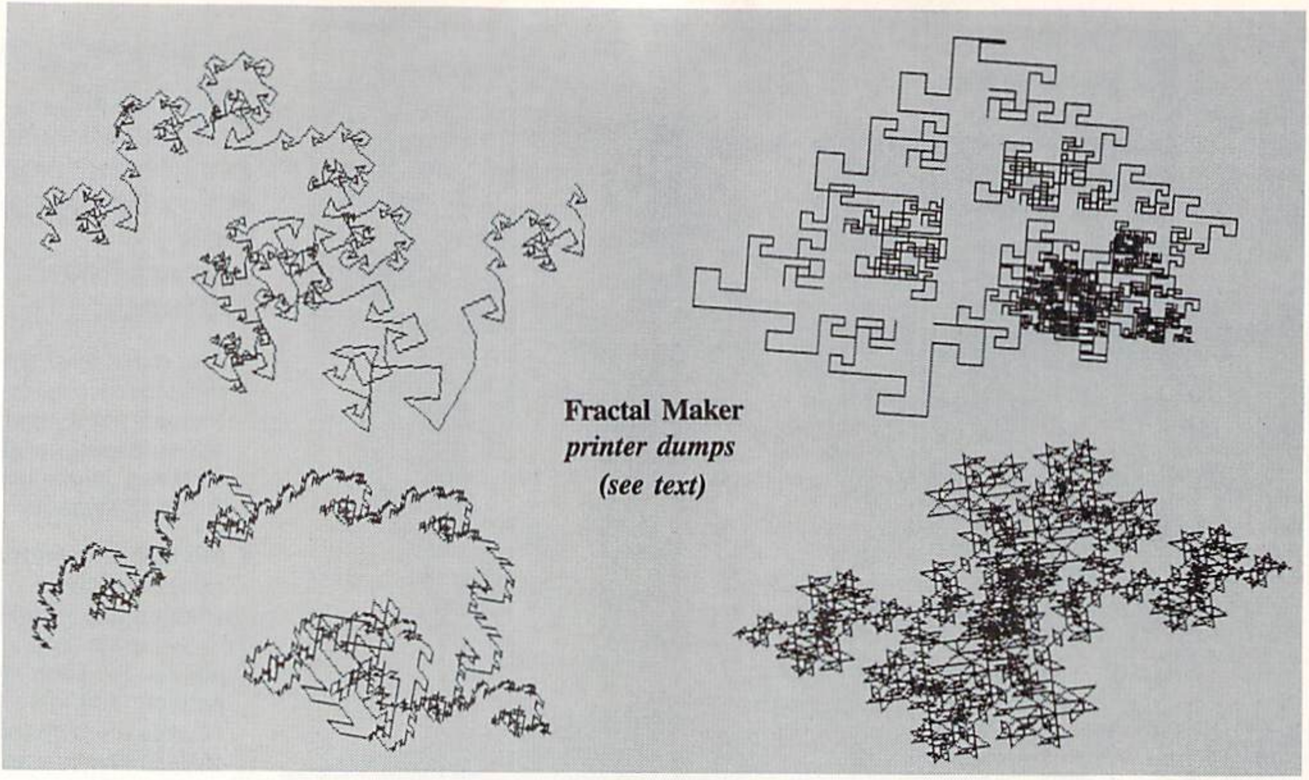
Once you know the minimum and maximum values for the displayed points of your fractals, you could delete the section of code which keeps track of those values. Simply delete the GOSUB 7100 statement in line 5310 as well as the statement in line 600.

Another way to really speed up the program is to run in the FAST mode. Unfortunately you won't see the image being drawn (that is at least half the fun), but at the end of each level, the program could return to SLOW mode to show the results.



Fractal Maker ***printer dumps (see text)***





Fractal Maker
printer dumps
(see text)

The routines at lines 11000, 12000, and 13000 are not accessible from the main program. You may use them to save the screen image to a disk file, to load the image from a disk file, or to print the image on an Epson-compatible dox matrix printer.

Once the image has been drawn, return to the menu and press Q to quit. The image still remains in the graphics memory. Type GOTO 11000 and give a filename to save the image. To load an image from disk, in direct mode type GOTO 12000 and give the filename. To see the image, type GRAPHIC 1.

The third routine will not be useful unless you have an Epson-compatible graphics printer. You may want to substitute your own screen dump routine for this one if you have a different printer. To print the graphics screen, type GOTO 13000. You may type FAST:GOTO 13000 to speed up the process. Then type SLOW when the printing is finished.

Other Resources

1. Dewdney, A.K. "Computer Recreations," *Scientific American*, Aug. 1985.
2. Mandelbrot, Benoit. *The Fractal Geometry of Nature.* New York, NY: W.H. Freeman and Company, 1983.
3. Sorenson, Peter R. "Fractals," *Byte*, Sept. 1984.

A distinguishing characteristic of fractals is their self-similarity at any level of magnification. Each portion has characteristics of the whole image. Other characteristics of fractals are discussed in the definitive volume on the subject, *The Fractal Geometry of Nature* by Benoit Mandelbrot (see below). It shows many other types of fractals besides the recursive curves we are discussing here. The terms in this article and the basic procedure for generating fractals are derived from the discussions in Mandelbrot's book.

For further reading on fractals and other fractal programs, try the other two articles listed below. *Fractal Maker* should provide many evenings (or months of evenings) of creative exploration. It may open up a whole new world for you. Let me know of your discoveries. ☐

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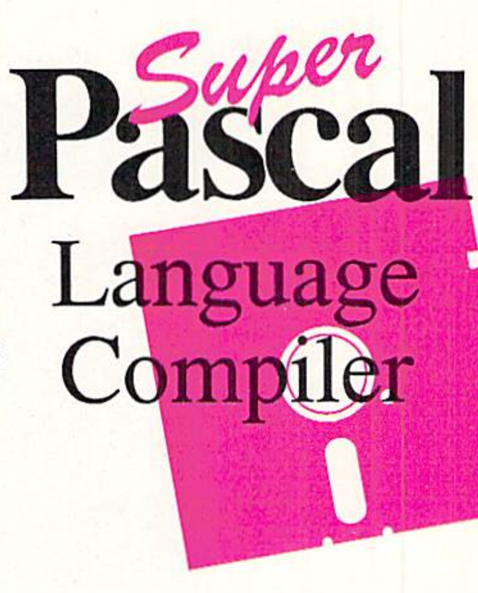
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SCRAMBLER

For the C-64

By Tony Brantner



Scrambler requires split-second timing as you run, jump, and climb from the ground floor to the top, dodging armed robot sentries and collecting bags of gold along the way.

Using *Flankspeed* (see page 87), type in and save a copy of *Scrambler.* Type SYS 49152 and press RETURN to start. The Scrambler enters from the lower left side of the screen. Using a joystick plugged into Port 2, push it to the left or right to move him in the corresponding direction. When you come to a ladder, push the joystick up or down to climb to a different floor.

Each floor is occupied by a roving robot sentry capable of firing deadly lasers. It's safer to climb the ladders to escape them, but you can press the fire button to jump over a guard or laser when necessary.

On each of the upper floors is a bag of gold. To collect one, simply touch it. Each bag is worth 50 points multiplied by the current level, which is shown in the upper left corner of the screen.

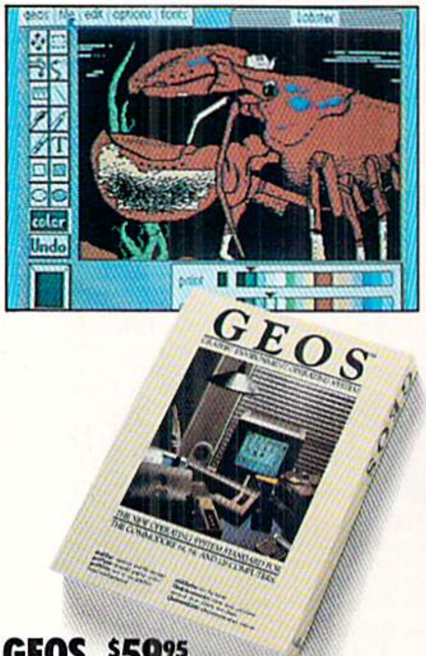
You begin each game with three lives. Once you climb up the top ladder, you earn an extra life and move on to the next level. A maximum of nine lives can be held in reserve. You'll need them, since each succeeding level features faster robots and lasers to contend with. There are twelve levels in all. Any time you need a break, press the SHIFT-LOCK key. □

SEE PROGRAM LISTING ON PAGE 91

PHOTO: MICHAEL R. DAVILA



IF YOU STILL THINK CO
PLAY AROUND



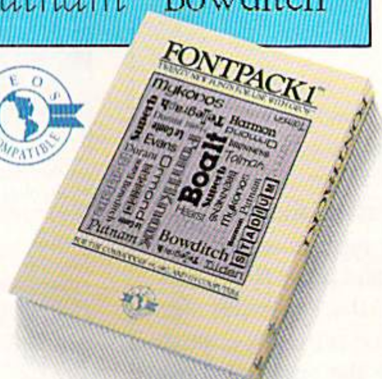
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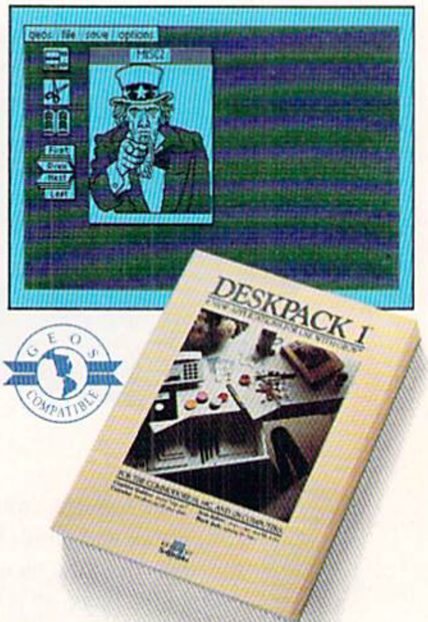
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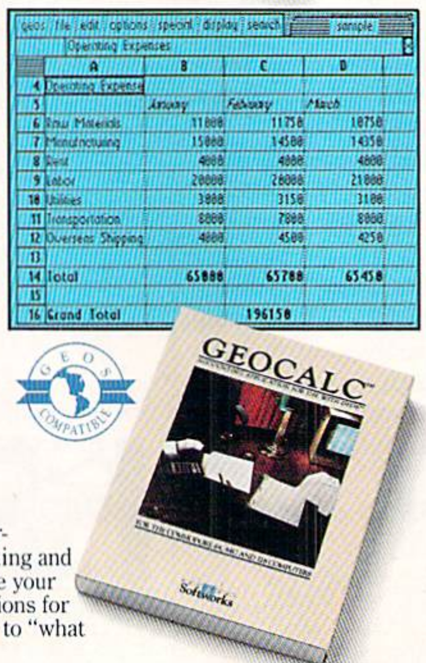






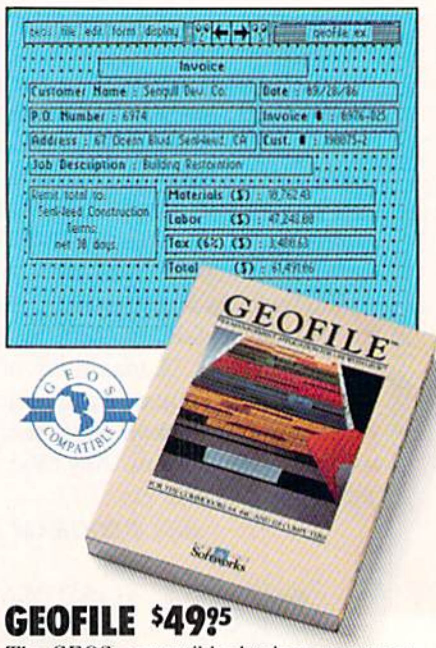
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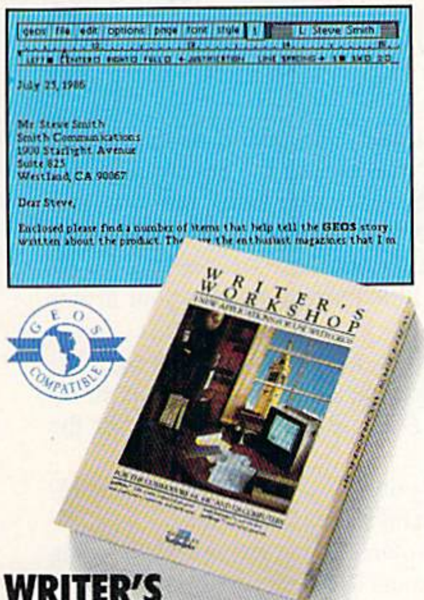
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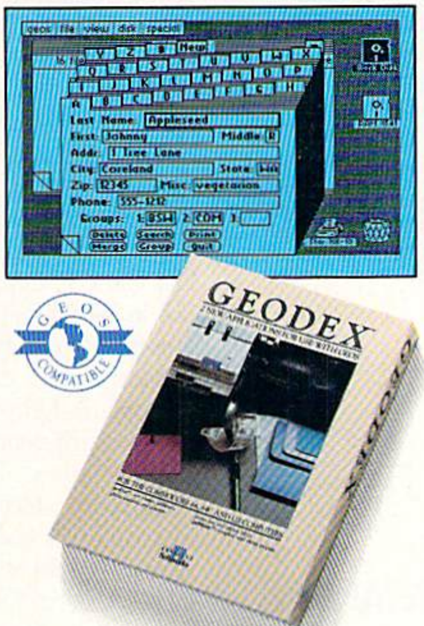


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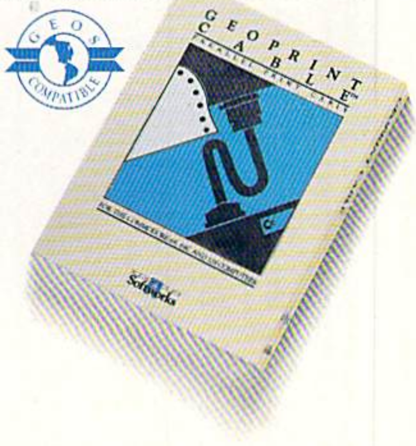
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PLANET DUEL

For the C-128

By Cleveland M. Blakemore

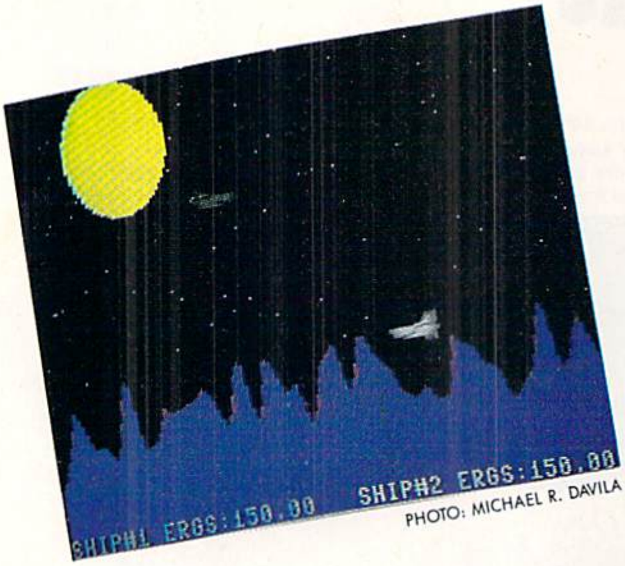


PHOTO: MICHAEL R. DAVILA

The energy gauge is sputtering on empty after a massive hit under your fuselage by a nuke.

Your right engine is smoking. Your shields are out. You know if you sustain any more damage, you and your ship will be toast floating over the rocky terrain below.

You're betting if you can just make it to the Mycho Braha Valley, you'll be able to lure the enemy ship into the trench under the natural bridge there, pull out, and hit him from above with a counterstrike. It's one chance in a million, but what do you have to lose?

If only you'd spent a little more money on your armor shielding...

Where is that alien scum, anyway? Hey! He's right behind you! He's firing his torpedoes! Aaaahhhh....boom!!!

The game is *Planet Duel*, a two-player game for the C-128 in BASIC 7.0.

This is a two-player combat game, played on the hires screen over a colorful asteroid plain.

You will design your own combat fighter by choosing from three different menus to select armament, shielding, and engines.

Each player starts with $800 to spend on his or her fighter, and it is not mandatory to spend it all. Any unspent money will be credited to the player's account, and reimbursed in the form of extra energy units in shielding.

Each menu of equipment has a selection of four different choices, as listed here. Each piece of hardware costs from $100-$400, so budget your money wisely. If you overspend on the first two menus and have no money left on the third menu, you will be issued a standard space corps hydrogen fuel booster (which crawls along like a covered wagon in space). So be sure to save some for your engine, which is the last and most important piece of equipment.

If you select the fastest engine, the Halycon overthruster, look out! You will fly around so fast you'll find it hard even to get

ARMAMENT
(Speed and damage of firepower)
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2) Photon charges
3) Plasma cannon
4) Nuclear missiles

SHIELDING
(Protective factor of armor)
1) Chromium plating
2) Deflector web
3) Kirlian field
4) Shrell sphere

ENGINES
(Speed and maneuverability of ship)
1) Atomics
2) Ion propulsion
3) Tachyon drive
4) Halycon overthruster

your opponents in your sight. However, you will be able to dodge his fire easily if you are dexterous.

When you play the game the first couple of times, expect several midair collisions with your opponent before you get the hang of it. It's easy to smash into each other with all that zooming and wrapping around. Midair explosions end the game in a stalemate and take you back to the menu.

You will each start out with 100 units of energy (ERG) in your shields, which may be more if you save some money from purchases.

Your missiles, launched by using the fire button, orbit the planet continuously until they hit something, so watch out for your opponent's fire wrapping around and hitting you from behind.

Space travel also wraps around the screen, but collisions will not occur unless both ships are touching on the visible screen! Use this wraparound to hide, or to come up behind your opponent.

You are safe from your opponent's fire if your ship is cruising below the level of the cliffs and mountains on the planet, and this feature may occasionally come in handy to rest up from battle for a few seconds.

The game is completely in BASIC, and you will probably be amazed at how incredibly fast and responsive it is in lieu of machine language. Actually this is my eighth game on the C-128, and it took all that experience to get the machine to run this way. There is a great deal about the C-128 that only trial and error can teach, and I had to learn from my mistakes before I could program a game like this. I hope you find it representative of Commodore's extensive advertising for "arcadelike" games in BASIC 7.0!

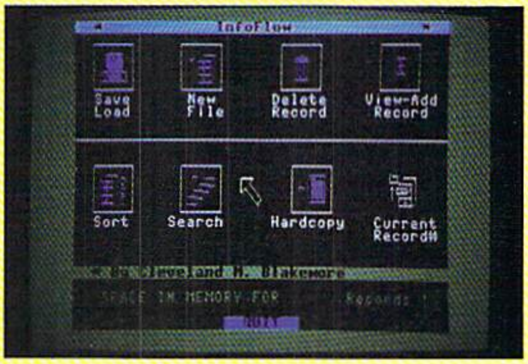
The first time you run the game, the program takes about 40 seconds to draw the hi-res image, but after that it will leave the picture on the screen, so there is little to no wait for the second round of combat. A friend of mine and I battled it out for 20 minutes before finally finishing a round, so I think you will find it challenging.

Experiment with different ship configurations until you get a fighter that handles the way you want, and then try modifying that ship to see if you can get an advantage over your opponent's design. The game can be a great deal like "scissors-rock-paper," with the design of your opponent's ship directly affecting the success of your own fighter craft, so there is definitely a great deal of strategy as well as dexterity involved in the game.

RUN STOP/RESTORE exits the game. Have a blast playing *Planet Duel*. □

SEE PROGRAM LISTING ON PAGE 105

INFOFLOW



Icon Database for the C-128

By Cleveland M. Blakemore

The C-128 is a personal computer that seems to lend itself to interesting new ideas. It has a way of bringing out a sort of experimental spirit in a programmer. One minute you're just puttering around on the keyboard, and the next thing you know you've worked out the basic structure of a program.

This is partly due to the fact that the version of BASIC on the C-128 is the most comprehensive, simplest language ever to come packaged with a micro. It is very easy to visualize programs in terms of commands and routines, and because there are so many available instructions there seems to be a good one for any situation that might arise.

If you're familiar with the Macintosh or Amiga, you already know what an icon-based system is and how it works. It is quite simply a menu of pictures instead of words. Rather than typing in a numeric choice, you use an arrow or pointer to select different pictures, and program flow is directed to the appropriate subroutine.

Most of these systems come packaged with a device called a mouse. A mouse is a small box with a trackball on the bottom that is rolled on a smooth surface to control the onscreen arrow. Although the following program is designed to work with the C-128's new mouse, the 1350, it will also work with any quality joystick plugged into Port 2.

The program takes a few seconds to boot up, as it has to POKE some data into memory. The screen will blank for a moment during this, and when it reappears you will be looking at the screen of *Infoflow,* an icon-operated database.

I confess I designed *Infoflow* for myself, as an alternative to many of the commercial databases I have owned. I incorporated all those features that were important to me; in fact, I tried to consolidate the best of all the databases I have ever used into one really terrific information filing system. I hope you will find it suitable for your needs, but you may miss certain features that would normally be there that I consider superficial. Since I use it mostly for addresses, dates, and record keeping, I designed it around these functions, and tried to keep it as streamlined and simple as possible. You will probably gather after a few minutes that I am a person who insists on doing things fast, fast, fast—and you would be right.

Before we go on, perhaps it would be best to briefly describe a database system and how it works for those of you who may be unfamiliar with them. A database is a software environment that is used to keep track of information, and to organize and store it in such a way as to make the information useful to human beings.

All databases have several things in common. They have the capability to add information, modify existing information, and delete, sort, list, search through, and print out information.

Usually the information is organized in a manner similar to information systems maintained physically on paper or some other medium. This would naturally mean something like filing cabinets, with drawers and folders. Since this type of system is easier to visualize for human beings, we'll be using this format for our database. You can think of each different file, with categories like Friends, Record Collection, or Important Dates, as being a drawer in a file cabinet. Now each folder in this file cabinet would be a RECORD, and each record would have several fields, or categories of information.

For instance, in a drawer called PERSONAL DATA, we might have 50 records. Each record might have three fields, e.g. Name, Address, Phone Number. Each field should have an entry, so that any time we wanted we could find information for that record, like the phone number of one of our friends, in the record with his name.

Now that we have a rudimentary understanding of databases, let's delve into *Infoflow* and see what makes it so different from other programs like it.

To select a choice from the menu, you merely move the arrow to the icon until it is touching (the arrow begins to "bump" or "stick") and push the button on your mouse or joystick.

There are eight icons to choose from on the screen. The upper four icons are labeled "SAVE/LOAD" (disk drive with disk above it), "NEW FILE" (filing cabinet),

PHOTO: MICHAEL R. DAVILA

"DELETE" (trash can), and "VIEW/ADD" (eyeball).

The lower four are labeled "SORT" (file cabinet with letters "ABC" beside it), "SEARCH" (picture of several folders with arrow running alongside them), "HARDCOPY" (arrow pointing to manuscript), "CURRENT RECORD" (file cabinet with drawer open and folder to left side).

We'll begin by creating a small database, to get a feel for the system. It's best to start out with something simple to experiment with.

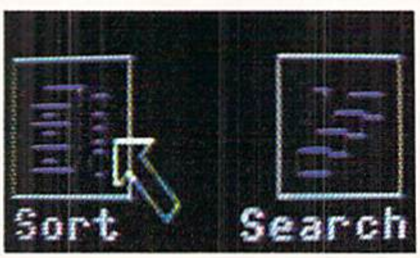


Our filing cabinet is empty when the program first starts, so we'll either have to load in an old file we have previously created or initialize a new file. Since this is our first time in *Infoflow,* we select the icon "NEW FILE". There is a buzz, and we see the prompt "Filename", indicating *Infoflow* needs to know what we are going to call the new file we are creating. We'll type in "Personal" and hit RETURN.

You'll notice that the input routine does not have a flashing cursor or question mark. That's because it's a special input routine that accepts commas, colons, and even quotation marks, putting *Infoflow* a notch above other databases in this respect. Using commas in addresses and lists is often very important, but BASIC 7.0 normally issues an EXTRA IGNORED error when it finds a comma in the input buffer. *Infoflow's* input routine also ignores all cursor movements and control characters, accepting only alphanumeric input. The only control keys functioning are the DELETE key to back up over mistakes, and the RETURN key. This input routine saves a lot of hassle and trouble normally associated with BASIC's input command. *Infoflow* also uses GET# to retrieve and save information to disk, because INPUT# does not properly receive strings with embedded commas.

Since *Infoflow* prefixes files on the disk with an "IF[" to identify only those files pertinent to it, filenames are limited to 10 characters or less. This should not prove to be a problem unless you have similar files you want to save and 10 characters is not enough to give them distinctive names. You could label one file in uppercase and the other in lowercase if you have such a problem.

After typing in the filename, you will be asked for the number of fields. Type in "3" (Name, Address, Phone) and hit RETURN. The maximum number of fields permitted is 99. Now the program prompts you for the Name and Length of each field. Type in the name of each field and the maximum length, in characters, you will want each field to be limited to. If you are not sure, the default is 160. Hit RETURN at the length prompt if you want the field to default to 160 characters. The max length for any field is 254 characters, which is pretty darn big, a lot bigger than the normal BASIC input buffer can even handle!



Now the computer will approximate how many records can be held in memory simultaneously and ask you if you want to proceed. If you like the file you have designed, hit "a" for accept. If you hit "r" the program will return to the main menu without creating the file.

When you return to the icon command screen, you will notice that "CURRENT RECORD" has been set to "1" and that the available record space left in memory is displayed at lower right, to keep you informed of how many more records you can fit into this file.

Now that we have a file created, let's go to "VIEW/ADD" and start putting something into it. Once you enter "VIEW/ADD", you will find yourself looking at the record number set in "CURRENT RECORD". You can flip forward through the records by moving the mouse or joystick right, and you can go back by moving it left. If you push your controller up, you will be in "INSERT/MODIFY" mode, at which time you can make new entries in each field or hit RETURN to leave the previous entry for that field unchanged. You will be limited to the maximum number of characters for that field that you set when you create the file. If you go over the 40 column line length, the screen will be scrolled down to make room for your input.



Each field is staggered one row to the right going down, to make each one more locatable.

If you enter a new record at the end of the file, the end-of-files pointer will be bumped up by one. Each time you enter a new record at the end of the file, the pointer will be bumped up by one to make room for another entry. The first field of each record is considered the "header"–if this header is blank, the record is considered blank. In order to make a new entry, you must put something in the header.

To exit from "INSERT/MODIFY", hit the button on your controller to return to the icon screen. You will notice that the last record you accessed will be set beneath the "CURRENT RECORD" icon.

It may seem too slow to move to the record you want in "INSERT/MODIFY". You may want to jump around very quickly in a large file, from record to record. This is the purpose of the "CURRENT RECORD" icon. Move your arrow to it and push the button. Now you can move rapidly forwards and backwards with your controller through the record numbers. For a fast change, move it left or right. For a really fast change, move up to count by tens through the records forward, or down to count backwards by tens. Once you have the record you want

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set beneath the icon, hit the button to exit. Now this is the first record you will examine if you enter "VIEW/ADD" again.

If you want to get rid of some old records in a hurry, select "DELETE", the trash can. You will be prompted to delete the Current record, Scan, or All Records. Hit "c" and the current record number will be erased. If you hit "s", you will be able to flip through the records as in "VIEW/ADD", and select records to be deleted by pushing SHIFT-D. Hit SHIFT-E to exit. You will notice that whenever a record is deleted, all the records above it are moved down to fill in the blank, and the end-of-file pointer is decremented by one.

If you select "a" for ALL records, the program will verify with a "Yes-No" prompt in case you have second thoughts. Otherwise the whole file will be erased irretrievably from memory, and you will be returned to the icon screen.

You will probably want to "SORT" your records alphabetically sooner or later, and there is a very fast Shell-Metzner sorting routine in the program for just this purpose. Select the field you want the sorting routine to use for comparisons (defaults to header) and the screen will go blank and flash for a few moments while the computer goes into FAST mode. The program returns with "SORT COMPLETE" before you are returned to the icon screen.

If you are looking for a certain entry, group of letters, or subject in your database file, you will want to use the "SEARCH" icon. The maximum length of the string to search for is 24 characters. After you hit RETURN, the program will display every occurrence of that string in your file, at which time you can either modify or insert information for that entry, just like in "VIEW/ADD". Each time you hit the button, the computer will begin the search again, displaying each occurrence of that string until it reaches the end-of-file marker.

If you are going grocery shopping, or you want to call each customer you have in your database, you will need a "HARDCOPY". The program prompts you for the range of records you want printed. The defaults are the beginning and ending markers for the file. The hardcopy will be aborted if the printer is not turned on.

After all this arrow moving and clicking, you may want to wrap things up and call it a day, so go to "SAVE/LOAD" and save your file to disk. Any existing file with the same name will be scratched and replaced with the new one.

Now that your data is safe on the disk, move your arrow to the lowest line on the screen and hit the button. The "QUIT?" bar lights up. Moving your arrow in any other direction will take you back to the screen, but clicking the button twice exits *Infoflow.*

The "SAVE/LOAD" routines and all I/O are extensively monitored for errors to prevent system crashes if the printer is off-line, or the drive device number is wrong, etc., but certain syntax and logic errors are allowed because of the fact that you may make a mistake in typing the program in.

Even the RUN STOP key is disabled, so your data is perfectly safe until you either exit the program with "QUIT" or hit RUN STOP/RESTORE.

I hope you find *Infoflow* indispensable for the C-128 utility library. Since it is one of the first utilities I have created for *Ahoy!*, I tried to make it as useful as possible. If you have any suggestions, modifications, or additions, please let the rest of *Ahoy!'s* readers in on the secret, and me too, by writing. ☐

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Featured This Month:

COMMODORING FOR THE CUP

Two Simulations Sail the Silicon Seas

By Joyce Worley

Hoist the sails, and over the bounding main we go! Old salts and young sea dogs can captain crews in the America's Cup race in simulations so real that landlubbers may become seasick before the Commodore gets back to dry land.

After 132 years of undefeated American yachtsmanship, the *Australia II* won the America's Cup match and took the Louis Vuitton Cup Down Under. The rematch, which climaxed in February 1987, has inspired two computer simulations.

The American Challenge: A Sailing Simulation (Mindscape) lets the computerist race a sailboat through seven increasingly difficult courses. Only after these are completed is the electronic skipper ready for a simulation of the America's Cup Race.

An onscreen instrument panel helps the computer captain monitor wind direction, wind speed, and boat heading. The sail, rudder, and centerboard are operated with keyboard commands.

The American Challenge, designed by Tom *(The Halley Project, Agent USA, Snooper Troops)* Snyder Productions, offers a choice of boat, course, and racing opponent. The computerist chooses to race the sailboat or a motorboat (a good way to learn about each course before trying it with the sailboat), then selects an appropriate opponent. Two computers can be connected by cable or via telephone modem for head-to-head racing, though each gamer must have *The American Challenge* game disk. With this setup, each yachtsman sees a representation onscreen of the other player's boat.

Solitaire gamers race against their own best previous performance, or the champion's time. In the one-player mode, the screen pictures a ghost boat so the skipper can see who's in the lead. The computer images of the opposition's sailboat can be toggled off and on at will.

All races in *The American Challenge* start with the wind from the North, and the boat facing West, sail unfurled. The starting line to the North is stretched between two buoys, with the ship at "standstill."



The Official America's Cup Sailing Simulation ***approximates the actual '87 race. Three skill levels vary weather conditions, time, and skill of computer foe. READER SERVICE NO. 131***

Simple keyboard commands control the craft. Pressing "F" or "D" pulls the sail in quickly or slowly, respectively, while "S" and "A" let the canvas out slowly or quickly. Touching "J" turns the boat to the left, "K" stops the turn, and "L" turns the boat to the right. Hitting "C" raises and lowers the centerboard (the board that runs vertically along the boat's hull to provide stability).

Before the race begins, the gamer sees a chart with the layout of the course. It identifies the general path the boat must take as a line which traces the route of the defending champion. Toggling the space bar at any time during the competition brings up the chart with the current positions of the two boats. After the race is finished, the chart reappears to display the actual courses of the winning and losing boats.

At the beginning of the competition, the gamer sees the boat from directly behind. Each press of an arrow key changes the perspective by 45 degrees. This permits the gamer to look to starboard, port, or even the stern of his or her own sailboat.

Sea and sky dominate the screen. Silicon Bay, where all races are staged, is circled by a few scenic highlights, including a bridge, lighthouse, towns, and hills. These add visual interest to the essentially boring display, and aid in navigation.

The American Challenge depicts the boat as an outline reminiscent of vector graphics, rather than as a filled-in image. It looks almost ghostly against the seascape, while providing mechanically accurate views of the sailboat's rigging.

The lower third of the screen holds the instrument panel. A compass,

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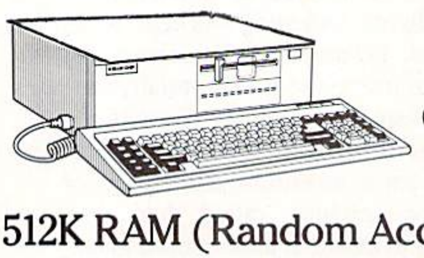
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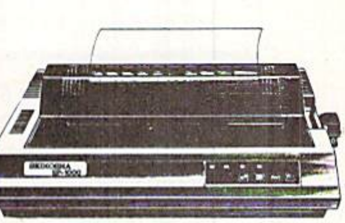
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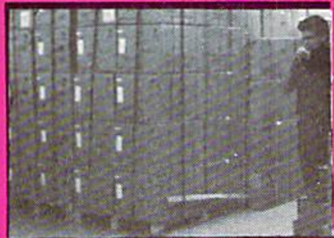
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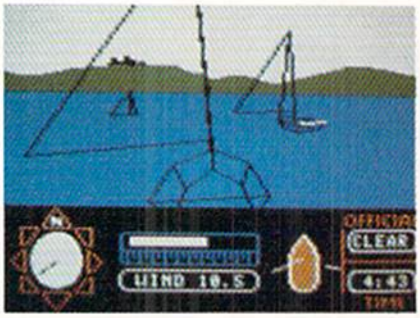
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American Challenge: *seven courses.*
READER SERVICE NO. 132

speed band, wind gauge, and a combination wind, sail, and centerboard indicator provide data needed to maneuver through the race.

The American Challenge comes with a tutorial on audio cassette that guides beginners step by step through the practice course. It's a good trainer, and should be very helpful to first-time sailors. These simplified instructions are also reprinted in the manual for easy reference, along with lots of tips and hints on the basics of sailing. Although it may take several playing sessions to master the techniques well enough to be a champion racer, the tutorial and accompanying manual make this simulation simple to understand and control.

The flip side of the cassette contains an original song written by Tom Snyder and Lincoln Clapp, "Win Back The Cup." It extols the need for America to regain its most famous sailing trophy.

The Official America's Cup Sailing Simulation (Electronic Arts) uses joystick commands to put a 12-meter yacht through its paces in a simulation of the actual 1987 America's Cup Match. The commander chooses the sails, picks a home country, and selects a one- or two-player contest.

In single-player races, the gamer sails the Challenger and the computer controls the Defender. Two-player contests employ separate joysticks for simultaneous control of the rival sailboats. There are three skill levels. They vary weather conditions, the amount of time available for the match, and the skill of the computerized opponent.

A weather report screen provides prerace information about wind speed and wind direction, plus a forecast of what to expect during the actual competition.

Weather conditions are a crucial element of this simulation. Handling a boat on a fair mild day is one thing, but it's an entirely different matter when the wind rises.

Next each captain chooses the starting headsail. Wind direction and speed are the major factors which must be considered. There are light, medium, and heavy genoas and spinnakers. The user's manual explains that the weather in the Indian Ocean always produces a wind from the West. In order to sail the first leg, directly into the wind, the manual recommends a light genoa.

The racers contest on a recreation

NEW BASEBALL GAMES IN TOWN

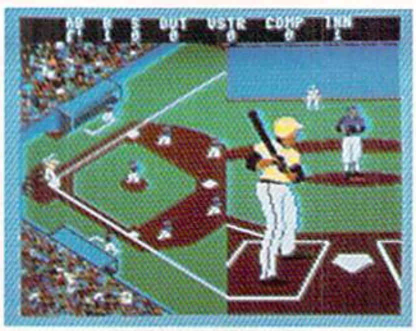
Rating the Rookie Baseball Programs for the Commodore

By Arnie Katz and Bill Kunkel

While the Mets and Red Sox steamrollered to a World Series collision last October, few sports commentaries appeared which didn't invoke the adage, "The game isn't over until the Fat Lady sings." This pithy bit of wisdom from Lawrence Peter "Yogi" Berra is also relevant to the field of computer baseball software.

Just when we think we've seen the last word in baseball programs, new titles burst onto the scene. It looks like the "game" of inventing electronic baseball contests won't be over until that "Fat Lady" sings a dirge over the very last Commodore computer in the universe.

This year continues the trend with offerings from SubLOGIC and Gamestar that will keep America's favorite pastime a computer gaming favorite.



Championship Baseball: *well-named.*
READER SERVICE NO. 133



Pure Stat Baseball: *most accurate.*
READER SERVICE NO. 134

Championship Baseball (Gamestar) supplants an earlier Gamestar entry, *Star League Baseball,* as the best action-strategy baseball game on the market. It's fitting that the designer who has dethroned Scott Orr as the Sultan of Sports is...Scott Orr.

Several leading designers have met their Waterloo in the last year or so, putting their names on products which were definitely inferior to their earlier work. Orr, on the other hand, has scaled new heights in 1986 and 1987. He never pauses for long to bask in the applause. That's probably why he is the mainspring of a string of superlative computer sports games which include *Star League Baseball, Star Bowl Football, On-Court Tennis, Star Rank Boxing, GBA*

of the triangular eight-leg Perth course, roughly 24.1 nautical miles in length. The starting line is stretched between a buoy and the Start Boat. At the sound of the first starting cannon, the two boats begin to maneuver into position. A second cannon shot, 30 seconds after the first, signals the start of the race.

The skipper operates the yacht in one of three modes. Helmsman Mode controls the boat's direction of movement. Each twitch of the joystick left (port) or right (starboard) turns the yacht 45 degrees. The player trims the mainsail or changes the headsail in Set Sail Mode. The gamer adjusts the mainsail by moving the main boom in or out with the joystick, and selects new sails by moving the joystick forward (for spinnaker) or back (for genoas), then tapping the button to choose from among three weights.

The Winching Mode lets the sailor lower sails by rotating the joystick counterclockwise, or hoist sails with clockwise rotation. Winching in particular is somewhat tricky. It's easy to give the stick one too many cranks in the wrong direction, and end up with a mess of tangled sails.

Rippling blue water fills the main display. The two colorful boats, one resplendent in yellow and green sails, and the other decked out in red and blue, are attractive and eye-catching.

The gamer views the boats from a three-quarters overhead perspective. If the two boats are too far apart to appear together, the display switches to a split screen. However, the commander can always call for an overview to show their relative positions on the course.

Reviewed in this article:

THE AMERICAN CHALLENGE: A SAILING SIMULATION
Mindscape
3444 Dundee Road
Northbrook, IL 60062
Phone: 312-480-7667
Price: $29.95

THE OFFICIAL AMERICA'S CUP SAILING SIMULATION
Electronic Arts
1820 Gateway Drive
San Mateo, CA 94404
Phone: 415-571-7171
Price: $32.95

A separate indicator panel for each boat appears in the lower corners of the screen. Each gives boat and wind speed, elapsed time, buoy, yacht and wind direction, and the number of the current leg of the race.

The official cup simulation is a best-of-seven match. During the contest, International Yacht Racing rules apply. The program punishes any infraction of these laws with a penalty of four boat lengths.

Following each race, a Results Screen lists the race number, winning yacht, and time. The captain then either starts the next race, continuing the seven-match series, or begins a new series.

There's quite a lot to do to keep a craft in the contest. Weather conditions change constantly, so the sails must be adjusted to match. The indicator panels keep both captains apprised of changes, and the appearance of the water also varies to reflect wind velocity. Rounding buoys generally requires a change of sails; this complex maneuver is so important to racing that the manual advises gamers to practice it repeatedly.

The documentation is an information-packed booklet that contains all the data needed to control the yachts, plus a wealth of material about the America's Cup Race and its history. A glossary explains nautical terms, and should have computerists talking like sailors in no time.

This is a challenging simulation. The joystick commands, nicely capsulized on a quick-start card for easy reference, are complicated. Once the computerist masters the control scheme and gets the hang of changing sails to match weather and sailing conditions, the race itself is strenuous and exciting. The computerized opponent, particularly at the top skill setting, is an able seafarer.

Both simulations have their strengths, differing chiefly in the depth of detail. *The Official America's Cup Sailing Simulation* is more complex, but it is also somewhat more exciting than *The American Challenge.* Either should provide hours of nautical entertainment even for those who can't tell a mainsail from a mainframe. *—Joyce Worley*

Basketball, GFL Football, and now *Championship Baseball.*

This one- or two-player program embellishes and extends the concepts introduced in *Star League Baseball.* In particular, Orr and his cohorts, under the steady hand of producer Mark Madland, have worked wonders with artificial intelligence.

Unlike primitive, arcade-style programs, the players are more than nicely drawn onscreen cursors. Each player's ability to bat, catch, throw, and run is rated on a one-to-three scale. *Championship Baseball* also divides players into contact hitters (liners) and power hitters (sluggers). Pitchers are also differentiated. The game rates them in three categories: speed, control, and stamina. Each has an arsenal of four different deliveries, and some display a sharper curve or a more overwhelming fastball than the norm.

Participants see the diamond from an upper deck perspective with home plate at the left edge of the screen. The players are a little cartoonish, but the animation is quite good.

The secondary display, which fills the right half of the screen during pitcher-batter confrontations, adds a lot of excitement to this crucial phase of the game. Managers view each pitch from the catcher's crouch behind home. The player at bat must time the pitch and, if it is in the strike zone, swing at the right moment to put the horsehide into play.

The joystick initiates all on-the-field action, whether the game is played against another human manager or the talented robot coach. Options are chosen by moving a cursor to select items from menus, while

game mechanics utilize a fairly simple set of stick and action button combinations. Those who become all thumbs when faced with anything more complex than a move and fire play-mechanic will appreciate the practice mode, which is also good for perfecting a fence-busting swing.

Two well-balanced squads, the Eagles and the Pumas, are included on the game disk, but *Championship Baseball* provides a menu-driven system to create an entirely new team from scratch. If the user picks the "New Team" option, the program presents the possible choices at each position. The manager can tailor the team to suit personal preference by selecting men who excel in the areas he or she deems most important.

Championship Baseball even allows managers to name each player! For the first time, any computerist can star in center field or shell the analog of a boss or teacher from the mound with heavy hitting. These customized squads can be saved on a formatted disk. Unfortunately, there is no initialization routine included on the game disk, so computerists will have to use the slightly more cumbersome method explained in the Commodore documentation.

League play, only possible in the solitaire mode, extends the simulation beyond a single contest. After the computerist picks a team and division, his franchise will play one of the five other clubs in the division. When the computerist's team has played each of its divisional rivals once, a winner is declared. If the human-directed team finishes first, the computer matches it against the winner of one of the other divisions. A victory at this level advances the team to the best-of-three Championship.

The program stores the results of games for the season in progress on a blank formatted disk. A sports page, The Gamestar Gazette, shows the current standings.

Championship Baseball is a worthy successor to the classic *Star League Baseball*. It is so much of an improvement, in fact, that avid fans of the classic game will want to update their software libraries with the new one.

Despite its strengths, *Pure-Stat Baseball* (SubLOGIC) may be destined to play Avis to *Micro League Baseball's* Hertz among statistical baseball simulations for the Commodore 64/128. The Quest design team has developed many innovative features, but deficiencies in graphics and somewhat pedestrian gameplay undercut the overall effect.

Pure-Stat clearly leads the computer baseball league in statistical accuracy. No program produces more realistic results in a one-game, series, or season replay. It treats most phases of the sport much more comprehensively than other such programs.

Reviewed in this article:

CHAMPIONSHIP BASEBALL
Gamestar/Activision
2350 Bayshore Parkway
Mountain View, CA 94043
Phone: 415-960-0410
Price: $34.95

PURE-STAT BASEBALL
SubLOGIC Corporation
713 Edgebrook Drive
Champaign, IL 61820
Phone: 217-359-8482
Price: $49.95

No hardball simulation weighs more factors to compute play results. Instead of a single, all-purpose fielding ratio, *Pure-Stat* employs separate ratings to measure each athlete's arm strength, range, and tendency to commit errors. This improves realism and provides managers with a legitimate reason to make defensive changes. For example, it might make sense to insert a strong-armed outfielder to reduce the chance that a runner will tag up and score a key run after a long fly out.

An important component of the hitting phase is that each batsman is rated separately for his ability against lefthanded and righthanded hurlers. This is not just a minor factor grafted onto the basic to-hit chance, either. *Pure-Stat* provides what amounts to two separate batting formulas for each player. Other elements which the program considers include pitcher fatigue, bunting ability, and the impact of park dimensions on player and team performance.

The main display is the statistics screen, not the diamond. This reflects the fundamental design approach which subordinates the audiovisual effects to the demands of creating a rich statistical model of major league baseball.

After the managers enter offensive and defensive orders, the view automatically switches to the field for a visual representation of the result. Since the stat-screen has all the pertinent numbers and command menus, the graphic screen is unmarred by distracting text windows.

The program tracks each play on one of two full-screen diamonds as it unfolds. When a lefthanded hitter is at bat, home plate is in the lower right corner with the third base foul line parallel to the bottom of the screen. With a righty at the plate, home is in the lower left corner and the first base foul line runs along the lower border of the screen.

No one could quarrel with the quantity of visuals in *Pure-Stat Baseball*, but quality is another matter. The simply drawn fielders are well-animated, but they sometimes move in odd-looking lockstep patterns. For instance, it's hard to suppress a smile when all three outfielders form a chorus line to chase after potential extra-base hits.

Some expected graphics are inexplicably omitted. For instance, there is no visual representation of a bunt attempt. Hitters look like they're swinging from the heels, even when a bunt attempt is in progress.

Ball action is uneven. A post-publication upgrade introduced a rounder and more lively ball, but it still behaves unrealistically at times. It is not unusual to see the center fielder snare what appeared to be a drive down the line.

Participants use a joystick or the keyboard to enter orders. First the pilot of the team at bat decides whether the batter will go for the fences,

swing normally, hit cautiously, bunt, sacrifice, or slap the ball behind a runner. Next comes decisions related to the running phase.

Besides the steal option, a manager can order men on base to challenge the other team's outfield arms or play it safe. This is one of the small but telling details which make *Pure-Stat Baseball* so rewarding for diamond strategists. Other programs let the offense set an overall running tendency, but only *Pure-Stat* presents the situation so exhaustively. For the first time, both managers must independently evaluate each outfielder's throwing ability.

Managers shape the pitching only in the most general way. The skipper decides whether to throw aggressively, avoid giving the batter anything juicy to hit, issue an intentional walk, or attack the runner with a pitchout. The battery determines actual pitch selection.

Finally, the manager positions the infielders and outfielders. The defensive team can draw in the infield all around to cut down a potential run, have the first and third basemen charge toward home, or guard the foul lines to prevent extra-base hits. In practice, managers have little to do unless runners are in scoring position. This makes *Pure-Stat Baseball* better for solitaire play than for head-to-head gaming.

Fortunately, the robot manager is quite formidable. It can't equal the savvy of a human coach, but it makes most of the proper decisions, including adroit use of platooning.

A set of "quick play" options takes most of the tedium out of ambitious season replays and other marathon undertakings. The computerist can personally replay the games and series he or she finds most interesting, and zip through the less appealing contests. It is possible to switch off the graphic display, eliminate timing delays, establish pitching rotations for both clubs, and have the computer simulate up to nine games in a few minutes each.

This is a complete package. Included with the basic game are eight all-time great teams of the past, a choice of three stadiums, a statistical compiler, a utility for trading players between teams and creating new ones from scratch, and a disk with teams based on the most recent major league baseball season.

There's no question that *Pure-Stat Baseball* sacrifices some frills to devote memory to its comprehensive mathematical model. Those baseball gamers who demand state-of-the-art statistical verisimilitude for season and series replays should enjoy *Pure-Stat Baseball*.

Are these the last new baseball programs for the Commodore 64/128? It's hard to see how publishers could improve on games like *Championship Baseball, Micro League, Hardball,* and *Pure-Stat.* Yet based on events of the last couple of years, we may have to eat these words in next April's *Ahoy!* *—Arnie Katz & Bill Kunkel*

HOWARD THE DUCK
Activision
Commodore 64/128
Disk; $34.95

An article in February's *Ahoy!* discussed the boom in games based on licenses, especially those derived from movies and television. This title provides an example of one of the pitfalls which can snare the unlucky software publisher.



Run afowl of the deranged Dark Overlord.
READER SERVICE NO. 106

When Activision bought this license, it believed "Howard the Duck" would be one of 1986's biggest movie box office successes. Unfortunately, the film never took wing. Except for People Magazine, which was so impressed with the film's estimated $35 million loss that it put Howard on its latest list of most intriguing "people," "Howard the Duck" was a non-event.

It would be regrettable if the failure of the film automatically doomed the game. *Howard the Duck* isn't likely to haul away many software awards, but it's pretty entertaining, especially for younger computerists.

The designers and programmers of a string of Gamestar sports hits like *Star Rank Boxing* and *Championship Baseball* have ventured into new waters. While the program, like the movie, fails to completely capture the essence of the fearless fowl created by Steve Gerber for Marvel Comics, it is, at minimum, a playable action-strategy contest.

The lengthy introduction establishes the lighthearted tone. After the credits roll, Howard demonstrates his breakdancing skill. Once he moonwalks off the stage, a pair of cartoon panels indicate that Howard is worried about Beverly and Phil, his two missing companions.

Where have they gone? The synopsis which crawls up the screen dispels the mystery for the player, if not for the dauntless duck. A new Dark Overlord has kidnapped them as bait to lure Howard to his doom. Because the would-be conqueror plans to use thermal power in his mad scheme, he has taken the pair to his base, Volcano Island.

The gamer can choose from among four skill settings. The higher the level, the more involved the quest. The "novice" game requires Howard to parachute onto the island, find a jet pack, and skim over the water to a trail which leads through the jungle to a waiting ultralite plane.

An "intermediate" player must fly the ultralite to the top of the volcano. The most difficult variants require Howard to fly into the crater, overcome the Dark Overlord, and throw the switch which halts the threatening eruption.

Hostile mutants erupt from the yellow mounts which dot the route. They are Howard's biggest opposition, other than the Dark Overlord himself. The feathered hero can nip this peril in the bud by stomping the mounds closed before the mutants emerge or by using "quack fu" to defeat them in direct combat. The computerist makes Howard kick by holding down the action button and pointing the stick. Leaving the button in the "up" position initiates a punch.

In keeping with the subject matter, this program is easy enough for even preteens to learn and play. It's not a snap by any means, but there's nothing in *Howard the Duck* to frustrate apprentice joystick jockeys. Even adults should get a kick out of the superb animation. Its little comedic touches, such as the way Howard shakes himself after getting wet, are certain to draw appreciative smiles. *Howard the Duck* also features excellent music, programmed by sound ace Russell Lieblich.

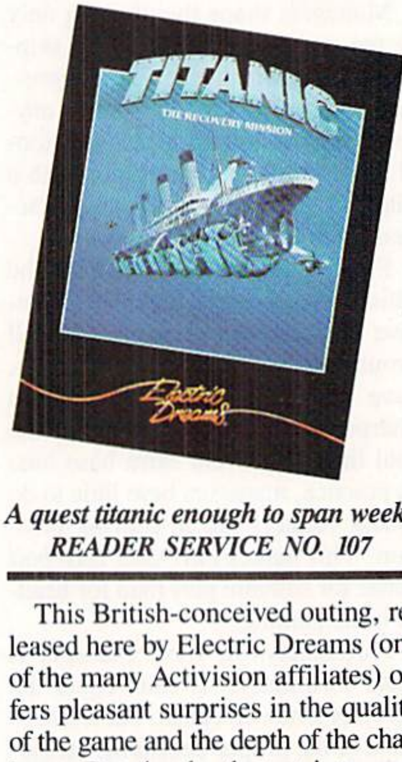
Continuous action and an onscreen countdown clock maintain a reasonable level of excitement. So skip the movie and apply the cost of the tickets and popcorn to this unassuming, enjoyable Activision entry.

Activision, 2350 Bayshore Frontage Road, Mountain View, CA 94043 (phone: 415-960-0410). *—Arnie Katz*

TITANIC: THE RECOVERY MISSION

Electric Dreams/Activision
Commodore 64/128
Disk; $29.95

The R.M.S. Titanic has been subject of at least two films, scores of books, and numerous underwater diving expeditions. The celebrated sea disaster in which an "unsinkable" liner went to the bottom remains fascinating to this day. Now a game has also sprung from the continuing interest in the ill-fated ocean liner.

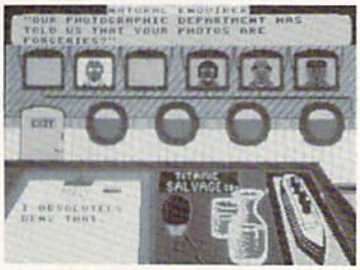


A quest titanic enough to span weeks.
READER SERVICE NO. 107

This British-conceived outing, released here by Electric Dreams (one of the many Activision affiliates) offers pleasant surprises in the quality of the game and the depth of the challenge. Put simply, the test is to grab treasures from the wreckage and then float her to the surface.

Less imaginative designers might have handled *Titanic* as an arcade program in which the gamer would fight off sharks, jellyfish, and the like while trying to raise the ship from the briny deep. But *Titanic: The Recovery Mission* makes the actual raising of the ship a small part of the overall challenge, even though it remains the game's ultimate goal.

As Dr. Robert Ballard of the Woods Hole Oceanographic Institute must have found when he visited the



***Press conferences are an enjoyable and important aspect of* Titanic.**

site of the wreckage a couple of years ago, it takes more than skillful divers and courage to accomplish this task. There are several other considerations. *Titanic* covers these by using multiple game screens.

The first of these displays is the Calendar Screen. Visible when the game boots, it is the pathway to all the other options. It shows the starting date of the mission along with a set of five icons, doorways to the Finance Room, the Diver, the Press Room, and Night Time. The disk-shaped fifth icon is used to save a current game or load an old one. (The "save" feature is vital, since solving this game at one sitting would be like building Rome in a day.)

Let's take the screens one by one. The Finance Room is the area to check on the financial backing of your trip. It is also the place to communicate with the people who supply money for the venture. The money isn't available all at once. Rather, it is handed out in weekly doses. How much is given depends upon how the mission is going.

The Finance Room can be entered voluntarily to check the books or to ask sponsors for more money, but the sponsors can also call the gamer back to the room to answer questions about the adventure. Ignoring these requests, even if busy exploring the depths of the wreckage, can dry up funds quicker than water in the desert.

The Press Room plays a very important part in keeping finances in the black. Press conferences, called by the gamer or by members of the news media, are one of the more enjoyable aspects of the game. The reporters appear on small television screens. The player must decide whether to direct the answer to just that reporter or to the group as a whole. The user picks the specific reply from a list of possible answers.

Good press is vital for the continued contributions of sponsors. Therefore, it's advisable to remain at the conference until all questions have been answered. Keep in mind the publication connected with each reporter and try to tailor the answers to that audience.

Then it's time to go underwater. The Titanic Salvage I, now called T.S.I, is the destination when the Diver icon is selected. The wreckage can be entered from any one of five points. The joystick controls the movement of the T.S.I.

The console of the T.S.I is the most impressive screen. It feels like the whole world is available at the touch of a button. Some of the many controls include floor/ceiling passage indicators (to move up and down levels within the ship), sonar screen (to keep track of sonar buoys laid down to aid in location of T.S.I within wreckage), camera and camera film indicators (don't forget to take pictures of some treasures to keep the boys in the press happy), and the robot arm (used to collect treasures).

Every feature is logically arranged and beautifully depicted. In all, the game is graphically superior to the other Electric Dreams products (i.e., *Rocky Horror* and *Spindizzy).*

After a hard day of diving, begging for money, and dealing with the media, a good night's rest is deserved and needed. That's the time to use the Night icon. It's also a good idea to save the game's progress. This is handy to do right after the program loads, since it isn't possible to restart the program without rebooting.

Titanic, which could take simulated months to finish, obviously isn't carried out in real time. The clock runs about eight times faster than real time. The captain of the mother ship must return to port every two weeks, for fresh supplies and to give the crew time off whether you like it or not.

In actuality, there is no time limit. As long as there's still money com-

ing in, take as much time as you'd like uncovering this mystery of the deep. You'll run out of funds before you tire of this intriguing entertainment.

Activision, 2350 Bayshore Frontage Parkway, Mountain View, CA 94043 (phone: 415-960-0410).

–Rick Teverbaugh

VIDEO VEGAS
Baudville
Commodore 64/128
Disk; $29.95

Ah, the lure of the big, bright lights! The noise, the excitement, the shows, the showgirls, and gambling keep things humming from Monte Carlo to Las Vegas. Wagering on games of chance is old as the Bible.

Video Vegas doesn't exactly create all the thrills of visiting the world's opulent pleasure palaces, but it does an admirable job of doing just what the packaging says it will: "Turn your personal computer into a casino."

Chance-takers can choose from among four different games: slot machine, blackjack, draw poker, and keno. The take is $1,000 when the game boots. The amount won or lost at each game is carried over to the next choice. If the total tumbles all the way down to zero, rebooting is the remedy, instead of a second mortgage on the house or a visit to loan sharks.



Video Vegas *slot machine craps out.*
READER SERVICE NO. 136

The *Video Vegas* box also advertises that the odds for each game are given and that they are adjustable. These statements are both true to varying degrees. A single keystroke is all that's needed to see the odds for any particular game. To adjust the odds (probably more in your favor), it is necessary to tinker with the source code. Unfortunately, this process is not covered by the game's documentation.

The opening screen is a close-up of the Vegas Strip with cars moving swiftly up one side and down the other. A tap of the spacebar (the game makes no use of the joystick) changes to the option screen for selection of your particular poison.

Easily the most lackluster of the four games is the slot machine. The only strategy here is to try to bet big when you're going to win and small when you're not. But that's a guessing process at best.

A closeup of the machine dominates the screen. All that's left to do is decide whether to risk one, two, or three dollars by tapping the "1", "2", or "3" key. Then sit back and wait for the handle to be pulled and the three tumblers to come to a stop.

The "?" key gives the odds and payoffs for each combination, and f1 reverts back to the scene on the Strip.

Keno isn't much better. Since that game isn't as widely known, a rundown of the rules might be in order. There are 80 numbers on a board from which the gamer chooses up to 15. Then 20 numbers are selected at random. It's necessary to hit more than half the picked numbers to get a payoff of any kind. As with any lottery, the strategy is minimal.

Keno's odds are very long, but the payoffs are huge. Hitting eight numbers produces $20,000 on a $1 bet. Too bad the odds against getting all eight are 200,000 to 1.

Poker is only marginally more satisfying. Play is against a fixed set of odds and a fixed payoff, much like the poker video machines which are popular in many arcades and bars. There is no dealer or other player.

It takes a pair of jacks or better to get the bet back. On a $5 bet, two pair wins $10, three of a kind pays $15, and so on up the ladder. Most traditional poker rules apply.

Really, the guts of this program is blackjack. While the other games are handled in a page or less of the documentation, it takes four and a half pages to cover blackjack.

Options are plentiful. It is possible to use from one to four decks for the deal. The more decks, the more difficult card counting becomes. As a tutorial for card counting, a practice banned at most casinos, *Video Vegas* isn't bad. The game has a built-in aid to help keep track of what cards have been played, and the documentation explains briefly two forms of card counting.

It is possible to split any hand with a pair, and doubling is also an option when one more card just might do the trick. Insurance against a dealer's upturned ace can be called at the touch of a key, but only expert card counters really benefit. It cuts losses and protects against a natural 21, but it'll never make a winner out of a losing hand.

In all, *Video Vegas* is a pleasant diversion. The program would have had more bite if it had also included some form of craps as a fifth game or in place of keno or the slot machine.

Baudville, 1001 Medical Park Drive S.E., Grand Rapids, MI 49506 (phone: 616-957-3036).

–Rick Teverbaugh

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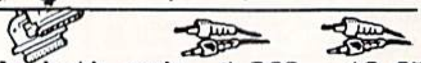


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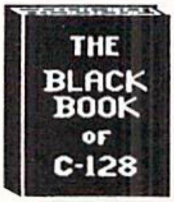
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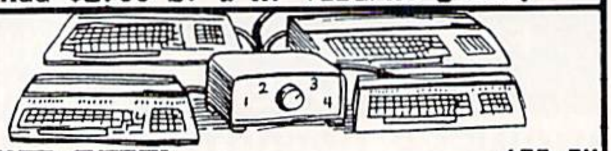
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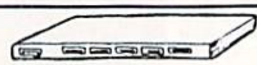
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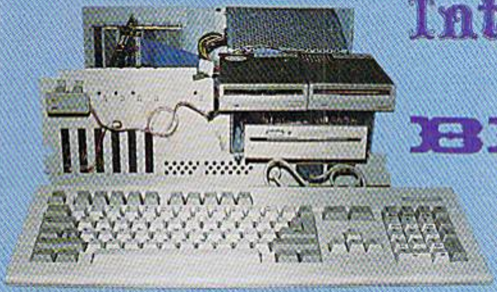
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PREVIEW of the AMIGA 2000

FEATURING Profound Prestidigitation, Internal Expansion AND A BRIDGE TO the WORLD OF BIG BLUE





It has been well over a year and a half since Commodore presented the Amiga, amidst much fanfare, to a packed hall at New York's Lincoln Center. We have used this time to sit back, gather up our socks, and ponder the significance of this machine which still represents the forefront of microcomputing technology. Nor has Commodore been idle during this interval, as we found out at a private showing this past December. At that time we were treated to a sneak preview of the Amiga 2000.

The Amiga 2000 represents a maturing of the new technology which was introduced with the Amiga 1000. The Amiga 2000 will also serve as a bridge to the extensive world of "Business Computing" in terms of the IBM PC and its clones. In brief, the Amiga 2000 has all of the Amiga 1000 capabilities on a chassis equipped with *Kickstart* 1.2 in ROM, one metabyte of RAM, one Amiga slot (86 pin), five Zorro slots (100 pin), one video expansion slot, and four IBM XT/AT slots. The CPU will accommodate three disk drives internally and two more externally.

The Amiga Side

First and foremost, the Amiga 2000 is an Amiga. That is, we expect it to be fully compatible with all the software already developed for the Amiga 1000. The bulk of the operating system has been placed in a quarter megabyte of ROM. The need for the *Kickstart* disk, which present Amiga users are all too familiar with, has thus been eliminated. This will speed up the initialization of the machine, as only a single disk, containing *Workbench* or an application program, will be required at boot up.

With the operating system in ROM it will no longer be possible to change versions by booting from a different disk. To allow for the operation of software, which may require earlier versions of *Kickstart* for proper operation, it will be possible to switch to *Kickstart* in the system's RAM. However, the viability of this procedure will have to be evaluated separately for each application. Although this will occupy 256 kilobytes of user RAM, it should not present a problem. We have found that software which requires the earlier *Kickstart* release will generally fail to properly recognize system RAM beyond the half megabyte of chip RAM. To allow for the possibility of operating system upgrades, the system ROMs will be socketed.

Text and Photos by Morton Kevelson

The Amiga 2000 represents a major addition to the hardware of the basic Amiga in nearly every regard. A clue to the extent of this expansion is given by the visible bulk of the CPU. Its sheet metal enclosure is a bit narrower than the Amiga 1000, but it is nearly twice its height. In addition there is no longer any space to slide the keyboard under the CPU. A cursory inspection reveals front panel positions for two 3½" disk drives and one half-height 5¼" drive. The default configuration includes only a single 3½" drive.

The optional drive slots may be filled with either floppy disk drives or hard drives of the appropriate size. The Amiga 2000 will be equipped to handle three internal and two external floppy disk drives for a total of three 3½" and two 5¼" drives. The hard

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drives will require an optional hard disk controller card. Commodore will be offering a DMA hard disk controller card which will include ST 506 and SCSI ports.

The basic machine will come equipped with one megabyte of RAM internally expandable to 9 megabytes (the Amiga 1000 may be expanded up to 8.5 metabytes). The default megabyte is equally divided between chip RAM and fast RAM. The default microprocessor will be the 68000 running at 7.14 MHz. An optional accelerator board, equipped with a 14 MHz 68020 microprocessor and a 68881 math coprocessor, will also be available from independent developers. The 68000 is internally a 32 bit microprocessor with a 16 bit address bus. The 68020 is the full 32 bit version of the 68000.

The Amiga 2000 provides for significant internal expansion of the hardware. In fact there are a total of seven expansion slots just for Amiga peripherals. The additional slots for IBM equipment will be discussed later. Five of the Amiga slots are designed in accordance with the 100 pin Zorro specification we discussed in the February issue. These slots will meet all the electrical requirements of the specification. However, the form factor of the expansion boards has been changed. The Amiga 2000's Zorro cards will have the same size and shape as the expansion cards for the IBM PC. If you read the *Amiga Section* in the February *Ahoy!*, you may recall our mentioning that Commodore had marked parts of the Zorro specification as seriously preliminary. Well, they certainly weren't kidding.

Fortunately, the electrical part of the expansion slots will still conform to the Zorro specification. Board makers will only have to change the physical layout of their cards. If the original board layout was done on a CAD system, then their redesign will require minimal effort. Commodore provided all Amiga developers with the details of the new machine at the Monterey Amiga developers' conference held last fall.

The sixth expansion slot is identical to the 86 pin external expansion bus on the Amiga 1000. Since it lacks any buffering, this slot permits direct access to the microprocessor's bus for the addition of coprocessors as in the accelerator board mentioned above. However, existing slap-on expansion boards cannot be readily plugged into this slot. Its internal location and orientation make this physically impossible. Once again, a minimal redesign of the board layout is all that will be required to modify existing slap-on card designs.

As the details of the new machine are already in the hands of existing Amiga developers, it would not surprise us if the present manufacturers of Amiga expansion cards had Amiga 2000 format boards available on the day the machine was released. We will also be looking for add-on cages for the Amiga 1000 which will duplicate some or all of the expansion slots provided with the Amiga 2000.

The addition of all this internal expansion has not resulted in a significant loss of external ports. In fact the only thing missing, which was present on the Amiga 1000, is the composite video output. The serial and parallel ports for printers, modems, and other standard peripherals will still be available. However, the serial and parallel ports will now conform to the IBM PC standard. This will permit the use of off-the-shelf cables with printers and modems. The dual mouse/joystick/light pen ports

Graphic Display Modes

Another release from our What's-all-the-fuss-about Department

Now that Commodore is preparing to enter the IBM PC market in a big way, we have started to look at what's available on the other side of the fence. One thing we couldn't help but notice was that an inordinate amount of fuss and attention was being given to IBM's new EGA (Enhanced Graphics Adapter) standard. This board, introduced in late 1984, costs between $500 and $1000 depending on the accompanying RAM. In return it will equip a PC with enhanced color graphics, making possible a host of new applications for the PC. Not unexpectedly, a host of clone makers are already offering substitute EGA cards at prices of only $300 to $600—a fraction (although a large fraction) of the cost of the IBM offering.

Having become accustomed to reasonably detailed color graphics on several generations of Commodore computers, we decided to find out what all the fuss was about. Just what does IBM's EGA offer? The results are summarized in the accompanying table.

Graphics Formats for Commodore and IBM PC

Machine	Resolution (pixels HxV)	Colors
VIC 20	192 x 184	8 out of 8
Plus/4	320 x 200	121 out of 121
C-64	160 x 200	16 out of 16
C-64	320 x 200	16 out of 16
C-128	640 x 200	Monochrome
EGA (PC)	640 x 350	16 out of 64
CGA (PC)	320 x 200	4 out of 16
CGA (PC)	640 x 200	2 out of 16
MDA (PC)	720 x 350	Monochrome
Hercules (PC)	720 x 348	Monochrome
Amiga	320 x 200	32 out of 4096
Amiga	320 x 400	32 out of 4096
Amiga (HAM)	320 x 200	4096 out of 4096
Amiga	640 x 200	16 out of 4096
Amiga	640 x 400	16 out of 4096

EGA = Enhanced Graphics Adapter
CGA = IBM Color Graphics Adapter
MDA = IBM Monochrome Display Adapter

Internal Expansion

The Amiga 2000 is the first Commodore microcomputer to offer extensive internal expansibility. Technically, all of the previous Commodore machines were fully expandable via external add-ons. Practically, the actual expansion that could be done was very limited. Let us take a close look at the significance of internal expansion as it is implemented on the IBM and its clones and the Apple II family of computers, versus the externally expandable design of the Amiga 1000 and the C-64.

To begin with, many of the features that are taken for granted by Commodore users have to be added to the machines from Big Blue and the Fruit Company. An Amiga or C-64 out of the box can be connected to several external disk drives, a printer, and a modem. All of the internally expandable machines require accessory cards for these functions. The C-64 is equipped with a user configurable port for serial or parallel bidirectional data transmission. Once again, these functions are optional on Blue and Fruit. The Commodore machines come fully equipped for color or monochrome display on a video monitor or home television. Big Blue out of the box has no visual output whatsoever. The fruit machine does provide a signal for a video monitor, but the TV connection requires an add-on RF modulator.

As a result, a large part of the internal expansion on these machines is generally devoted to features which are built in on the Commodore product.

The advantage of internal expansion is in the clear definition of the configuration for external peripherals. This is of the greatest benefit to third party peripheral manufacturers. In turn, the popularity of the host machine is significantly enhanced. A manufacturer of an IBM or Apple peripheral is able to guarantee that his product will function in the machine. The user has every reason to expect his add-on cards to function harmoniously with any other peripherals he may already have. If problems do arise, the responsible party is readily identified.

The provision for significant internal expansion also requires that the machine's power supply be designed for some amount beyond the immediate requirements of the main machine. For example, the Amiga 2000 will be equipped with a 200 watt power supply.

In the C-64 world peripherals will generally monopolize their associated expansion port. For example, multiple expansion port cartridges cannot be used. These cartridges will invariably conflict with each other. Commodore has addressed the compatibility problem on the Amiga 1000 by publishing autoconfiguration and intercard communication protocols. However, in the absence of a central testing agency, there are no guarantees that products from different manufacturers will function harmoniously. The presence of an internal expansion chassis in the Amiga 2000 provides the common ground for all peripheral makers.

have been moved to the front of the console.

Video display is the Amiga's 4096 color analog RGB or the more limited RGBI format. If composite video or modulated RF (for television use) is required, an optional video card will have to be installed. The composite video functions have been delegated to a dedicated video slot located at the right rear corner of the main board. This slot may be used for an optional composite video or genlock type of peripheral. Commodore will be offering a video card which will provide standard NTSC or PAL video output. We expect third party developers to take advantage of this slot by offering specialized video applications for the broadcast industry. Many users of the Amiga 1000 have expressed interest in this type of expansion.

Disk drive expansion has not been neglected. The CPU can accommodate a second 3½" drive as well as a half-height 5¼" drive. The former is intended for the Amiga side while the latter is for use by the optional PC card. Alternatively, hard disk drive modules may be substituted for either the 3½" or 5¼" floppies. This still leaves room for two external drives, a 3½" unit and a 5¼" unit, both configured as Amiga drives.

The drive controller for the optional disk drives is built into the basic system. The optional Commodore DMA hard drive controller card will also provide connections for two ST-506 drives as well as an SCSI (Small Computer System Interface) port. The ST-506 format port is used by the IBM PC and its compatibles. The SCSI is the interface for the Apple Macintosh and is becoming something of an industry standard.

Some additional features have found their way into the system. The Amiga 2000 will incorporate a built-in clock/calendar with battery back-up. Users familiar with Amiga DOS will immediately recognize the value of this accessory. The keyboard has also been extended. The key count is now 94 (96 on the international version), up from 89 on the original Amiga. The numeric keypad has been extended to 18 keys, including open and close parentheses and all four of the basic math operators. All of the PC style labels have also been added to the front face of all the appropriate keys. The cursor keys are now in an inverted "T" layout, and the function keys have been separated from the main keyboard in PC clone style.

The PC Clone Side

The Amiga 2000 actually has the built-in hardware for adding a complete PC XT or AT clone. These machines utilize the 8088/8086 and the 80286 microprocessors. The potential also exists for expansion to include an 80386 microprocessor.

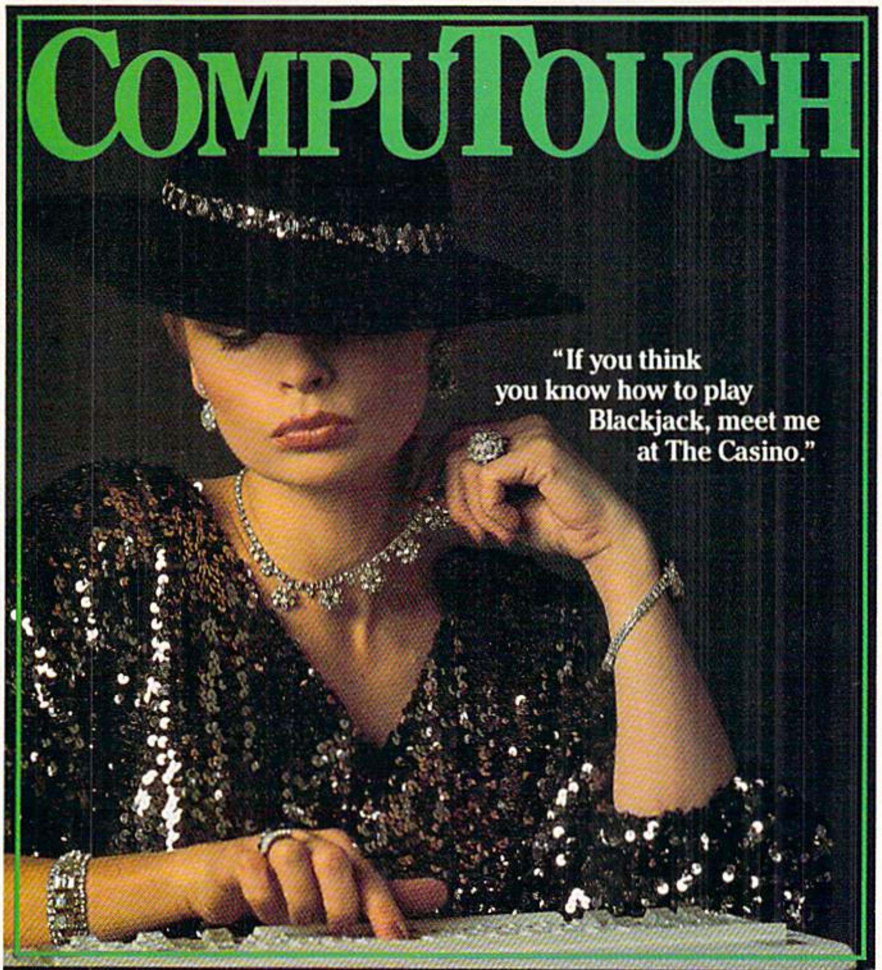
However, standards for the 80386 microprocessor expansion bus have not yet been established. This PC expansion has been implemented by incorporating an AT compatible, four slot expansion bus on the main circuit board.

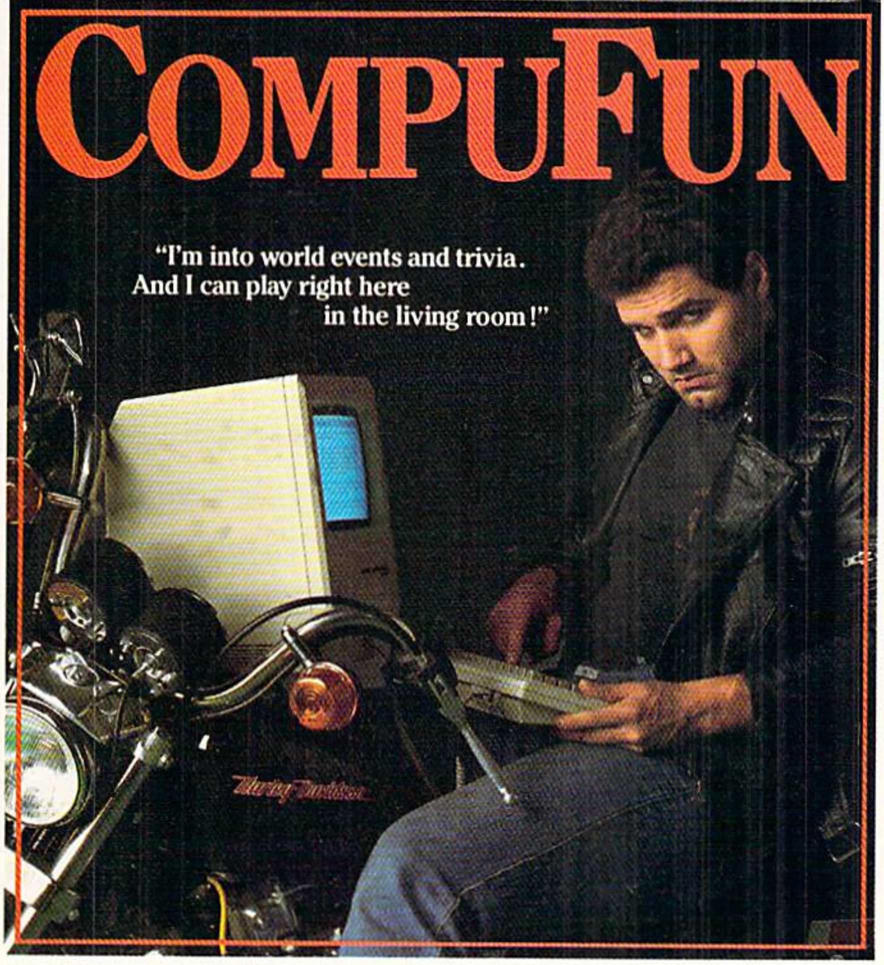
The design of the Amiga 2000's expansion bus requires some qualification. The four PC slots consist of two AT type slots and two XT slots. The AT slots add a second 36 pin connector to the original 62 pin connector used by the XT style cards. However, the printed circuit traces for the AT extension are present for all four slots. Thus the additional AT connector extensions can be easily added if required. Note that the skirt overhang on many XT board designs limits their installation to the positions where the AT extension slot is vacant.

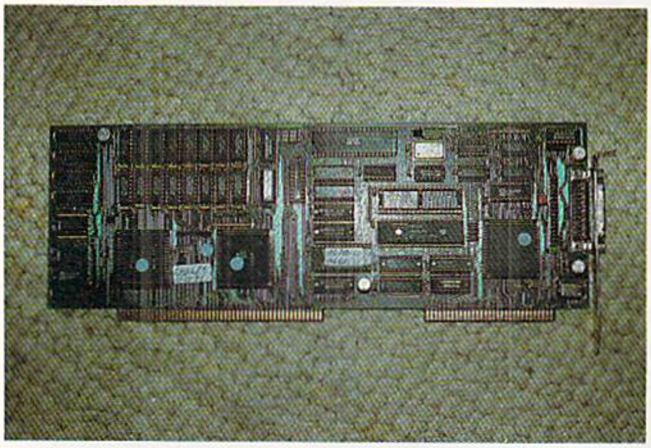
The two AT style expansion slots are in line with two of the Amiga's Zorro slots. This is essential to the design of the system. The PC XT or AT compatibility is achieved by installing a bridge card which spans one of the Zorro-XT/AT slots. This card will include an 8088 or an 80286 microprocessor, its own RAM and ROM BIOS, a pair of custom ICs to implement the Amiga-PC interface, and a disk drive interface. In effect this amounts to an XT or AT clone on a card. Inter system communication will be maintained via a 64 kilobyte, dual-port RAM as an inter-process buffer with a 64 kilobyte dual-port scratch memory on the Amiga side.

The XT version of the bridge card, model A 2088, will include an 8088 microprocessor running at 4.77 MHz, its own 512 or 256 kilobytes of RAM, 16 kilobytes of ROM BIOS and an interface for one internal and three external 5¼" 360 kilobyte disk drives. The system will use the Amiga's parallel port for printer interfacing unless a PC communications card is installed in one of the three remaining slots. The operating system, supplied with the card, will be MS-DOS version 3.2 which supports both 3½" and 5¼" inch disk formats.

IBM type monochrome text and







The Janus or Bridge board (actual name not yet set) is a ½M IBM PC clone on a plug-in card. Zorro connector is to the left with PC connector to the right.

color displays will be available simultaneously through Amiga windows. The borders of these windows may be turned off to permit the full 80 column display. Since the PC displays are implemented using the Amiga's graphics, full user control of screen format and color is available via the Amiga's *Preferences* tool. This applies to both the monochrome and color PC windows. The PC windows may also be sized to run alongside any number of Amiga applications. The reduced size PC windows may be scrolled across a full PC text screen.

The PC side of the system will receive considerable support from the Amiga side. To start with, the sharing of low cost, readily available PC peripherals will greatly enhance the operation of the Amiga system. The most notable example is the partitioning of hard disk drives for use by both systems. With this arrangement a low cost (under $500) PC hard card may be installed in one of the PC slots. Under software control the hard drive's storage capacity may be partitioned for use by both systems. If desired, the entire capacity may be assigned exclusively to the Amiga.

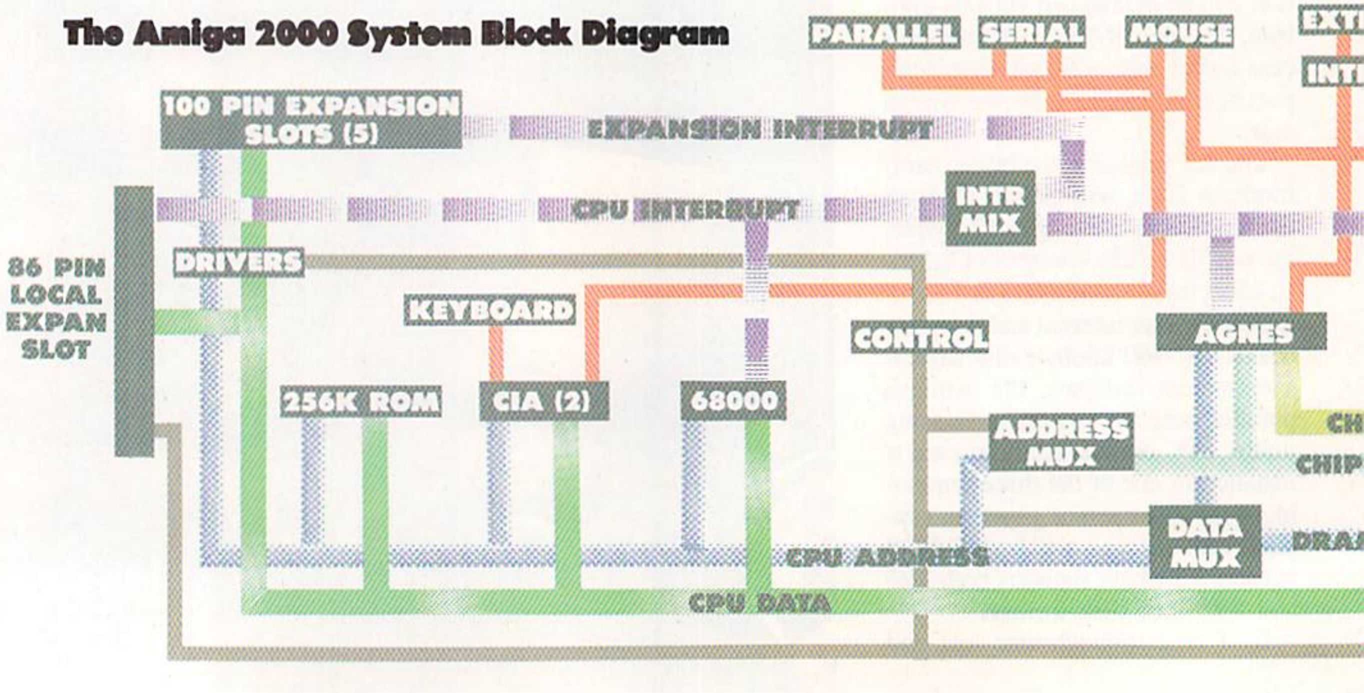
Additional hardware and software applications will be forthcoming from Commodore as well as third party developers. These applications will promote greater integration between the Amiga and MS/DOS operating systems. One of the first of these utilities will support cut and paste operations between software packages running on the two systems. The possibilities are endless.

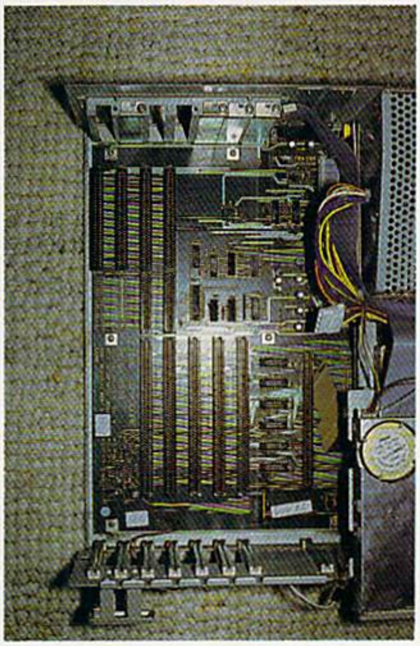
Conclusions

At a year and a half after its introduction the Amiga is still at the technological forefront of microcomputing. Nevertheless, the size of the PC "business" market is just too large to ignore. With the Amiga 2000 Commodore will be bridging the gap between the advanced features of the Amiga and the widespread "respectability" of the PC clones. In the process we feel that several notable things will be achieved. First, Commodore is demonstrating its continuing support for the Amiga design by offering a fully compatible and highly expandable upgrade path. Secondly, the "business" community will now have an excuse to buy an Amiga for their own use. Once it is in their hands we feel confident that the Amiga will make the proper impression.

With this new machine Commodore has effectively extended the definition of the Amiga's multitasking

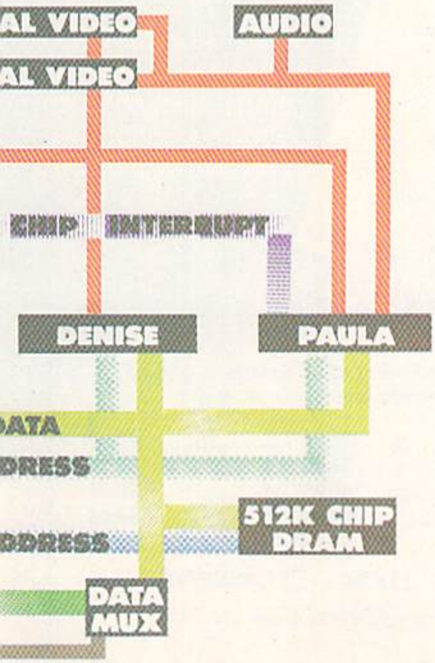
The Amiga 2000 System Block Diagram





Slot machine close up. Four PC XT type connectors at top, five 100-pin Amiga connectors at bottom.

operating system to include multiprocessing and multioperating system. Since the add-on processors all have their own system resources, both hardware and software, they will all run at full speed. In this mode, the Amiga need only maintain appropriate windows for input and output.



JOANN CASE

New Amiga 2000 Peripherals

A 2088
An 8088 microprocessor board which provides PC XT compatibility. Price will be less than $500 for a board with 512K of RAM.

A 2286
An 80286 microprocessor board which provides PC AT compatibility. Price and configuration to be determined.

A 2050
2 MByte Amiga RAM board which can be populated as ½, 1, or 2 MBytes. Price will be less than $600 for the 2M version.

A 2058
8 MByte Amiga RAM board which can be populated as 4, 6, or 8 MBytes. Price is dependent on the cost of the one megabit RAM chips when it is introduced.

A 2094
Amiga DMA Hard Disk Controller board for two ST506 hard drives plus an SCSI port. Price will be less than $250.

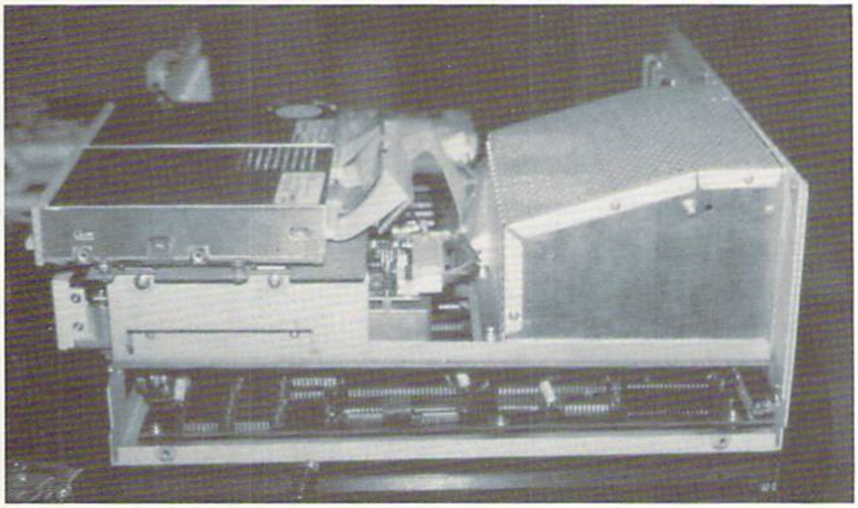
A 2060
Amiga NTSC composite video and RF modulator board. Price will be less than $100.

A 2002
RGB and composite video color monitor. Price will be under $400.

A 2080
Color monitor with long persistence phosphors for use with interlace mode. Price will be less than $500.

This is a task which the Amiga does very well inasmuch as its operating system was designed with this in mind. Most of the windowing operations are handled by the Amiga's own trio of custom coprocessors, leaving the 68000 free to run unique Amiga applications.

In the ultimate scenario we can expect a multitasking operating system to become available for the PC world. This is the intended purpose of the 80286 and 80386 microprocessors. We find it interesting that although the PC AT is currently available, its operating system is still that of the original PC. The operating system to take full advantage of the 80286 microprocessor is still six months to a year away. By comparison, the Amiga's operating system already had multitasking capability over one year ago. When this comes to pass we can see an Amiga 2000 multitasking several Amiga applications alongside a PC window which in turn may be multitasking several PC applications. In effect, the rest of the world will finally be catching up to where the Amiga was over one year ago. □



View from right shows disk drive stack and power supply enclosure. At bottom we have tantalizing glimpses of the RAM, ROM, and microprocessors.

Chip RAM v. Fast RAM

Chip RAM is so designated as it is the only RAM which is directly accessible to the Amiga's graphic and sound coprocessors. Data stored in chip RAM can be manipulated by the coprocessors without the intervention of the 68000 microprocessor.

The term fast RAM has been a source of confusion for Amiga users. The implication is that chip RAM is somehow slow by comparison. This is just not so. The speed of the 68000 is fixed by the internal clock at over 7.14 MHz. Thus code residing in chip or fast RAM can execute at the same speed. However, fast RAM is inaccessible to the Amiga's graphic and sound coprocessors. Any graphic or sound data must be first transferred to chip RAM by the CPU before it can be acted on by the coprocessors. It is this inability of the coprocessors to access fast RAM from which its speed advantage derives.

Most of the time, the 68000 and its coprocessors function in perfect harmony. The Amiga is designed so that access to RAM by the 68000 and the graphic coprocessor occur on alternate clock cycles. Occasionally the graphics coprocessor gets greedy by demanding more than its fair share of time. When this happens the 68000 is put on hold while the graphics coprocessor does its job. By comparison the 68000 is never forced to wait for access to fast RAM, no matter what the graphics chip may be up to.

Strictly speaking, a better name for the expansion RAM might be "RAM which cannot be accessed by the coprocessor chips, thus the 68000 is free to execute code without hindrance." Most developers find this to be somewhat cumbersome. Besides, it makes for poor advertising copy. As a result we have the somewhat misleading, but esthetically pleasing, fast RAM.

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LAPS

For the C-64

By James C. Hilty

The most famous auto race in the world, the Ion International 500, is scheduled to be run this weekend. You have always dreamed of winning the grand prize of one hundred thousand dollars in cash and a year's subscription to *Ahoy!* Unfortunately there can only be 20 cars in the race, and 19 positions are already filled. You must post a better time in the qualifying laps than your opponent or it's wait till next year!

Laps is a two-player 3-D racing simulation for the C-64. The players take turns running three qualifying laps, and the racer with the best average time after the three laps is the winner. When the game is first run, a prompt asks for the names of the racers. If you wish to practice running laps alone, simply press the RETURN key for each name; otherwise enter the name of each racer (up to 10 letters). The name of the first player is displayed on the screen. The speed is shown as 50 mph. The player car (red) cannot go slower than 50 mph or faster than 300 mph. The racer uses a joystick in Port 2. The same joystick is used by both players. To begin your lap, press the fire button. Pushing the joystick up increases your speed, while pushing it down slows you down. Pushing the stick left or right moves you left or right. After your lap is completed your time is shown in the bottom half of the screen. The second racer's name comes up and he runs his lap. This continues until each player has driven three laps. The average time for each racer is then calculated and a winner is declared.

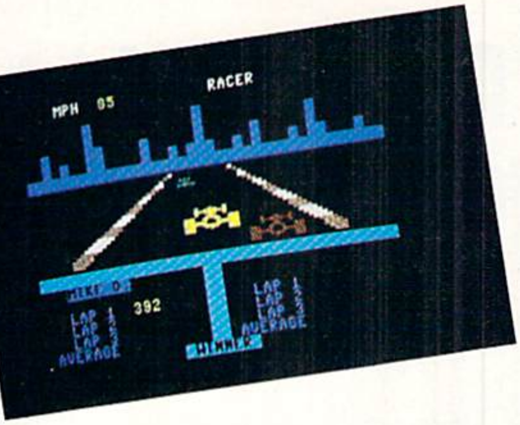


PHOTO: MICHAEL R. DAVILA

THE TRACK

The upper half of the screen shows your car on a 3-D racing track with a city in the background. If you hit the red and white track boundaries during a lap, your car crashes, time is added to your lap time, and your car must start at 50 mph. Your position in the lap stays the same. The same is true if you crash into one of the other cars that happen to be on the track. There are green cars on the track that travel at high speeds and there are yellow cars on the track that are moving very slow. These cars are obstacles and should be avoided, as a crash will cost you time.

Turns on the track appear suddenly and are very treacherous. If you enter a turn at too high a speed, you will fly off the track. Don't forget to steer your car when you are in a turn, or you will end up on the other side of the road or crash into another car.

STRATEGY

How you run your race depends on you and your opponent. A conservative race run at slow to moderate speeds could give you a decent time and force your opponent to try to drive a faster, more wide open race. The last lap for each player will often decide the outcome of the game. Remember, the winner is decided on the average time of all three laps, so one bad lap time doesn't put you out of the game.

Will your dream come true? Will you win a place in the Ion International 500? It is up to you, the race car driver, to decide your fate against a worthy opponent. ☐

SEE PROGRAM LISTING ON PAGE 107



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HACK-PACK

Metacomco
Commodore 128
Disk; $39.95

BASIC 7.0 on the C-128 is the best BASIC Commodore has ever produced on an eight bit machine. Actually, among Commodore BASICs, its only competition comes from AmigaBASIC. Nevertheless, if you look hard enough (or even just a little bit) you can always find room for improvement. *Hack-Pack* for the C-128 feels that it has found that room for improvement, and on that point we will agree with them. *Hack-Pack* also bills itself as "The ultimate utility pack for the 128." We won't go so far as to agree with them on this point, but they are entitled to their opinion.

Hack-Pack is actually a collection of three utilities which will make life with the C-128 and BASIC 7.0 even better. We will look at each of these in turn.

Toolkit

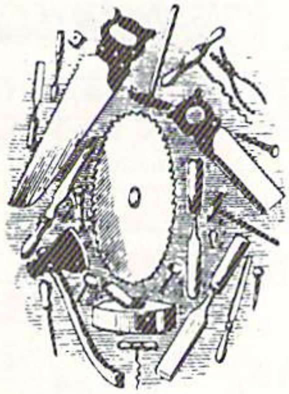
In deference to the *Hack-Pack* manual we will start with the Toolkit. As its title suggests, the Toolkit is a collection of commands which will make the editing of BASIC programs easier than before. To be specific, the Toolkit is a collection of eight commands which we list herewith:

***Hack-Pack's* Toolkit Commands**

FIND	CHANGE
DUMP	INFO
MERGE	TYPE
SIZE	QUIT

If this selection seems a trifle sparse, be it known that it is deliberately so. *Hack-Pack* shuns the implementation of "nonsense commands that no one ever uses such as BEEP and FLASH!" (page 2 of the manual). Be that as it may, BASIC programmers will definitely find these commands useful. In particular the FIND and CHANGE commands are welcome additions.

The FIND command is one which no self-respecting programmer should have to do without. Yet for some reason, every version of Microsoft BASIC we have come across lacks this essential feature (Commodore BASICs all owe their origin to Microsoft, and the C-128 lets you know this in no uncertain terms). Even AmigaBASIC fails to rectify this sorry state. In all fairness, Commodore has in the past made some efforts to provide FIND for their loyal users. The VIC 20's *Programmer's Aid Cartridge* and the C-64's *Simons' BASIC* both included FIND commands in their repertoire.



FIND lets you specify and locate any text string in a BASIC program. It works on tokenized keywords as well as literals. With Toolkit you must flank the search-string with delimiters. A delimiter is simply any character that is not part of the search string. The quotation mark may be used as a delimiter, but it has a special effect. It places the computer into quote mode, which of course turns off tokenization. Thus quotes are used to locate literal text strings which may also contain BASIC keywords.

FIND's output is simply a listing of all program lines which contain the search-string to the screen. So if you have a long program, keep your finger in the vicinity of the C-128's NO SCROLL key. Alternatively you may redirect the computer's output to the printer using the traditional OPEN4, 4:CMD4 command string. Toolkit does not add the ability to redirect output to the printer in spite of the acknowledged usefulness of such a feature. When using CMD be sure to conclude the output with a PRINT #4 command to unlisten the printer and clear the printer's buffer. Failure to do so will result in problems with disk access.

The CHANGE command combines FIND with replace. All occurrences of the search-string will be replaced by the specified replacement-string. The range upon which FIND and CHANGE operate can be restricted by specifying a line-range, as with the C-128's LIST command.

The DUMP command provides you with the names and values of all your program's variables and the names of all functions and arrays. Note that only the names and not the contents of arrays will be displayed. DUMP accepts two modifiers which restrict its output to either variables or arrays. DUMP's output is formatted for the 40 column display no matter which display is actually in use.

The INFO command provides a detailed report of the memory usage by your BASIC program. This information includes the length of the program with separate figures for the memory used by variables, arrays, and strings. It also reports on the memory which is still available for program and variables. INFO is in effect an enhanced version of BASIC's FRE function. Unlike FRE, however, INFO cannot be invoked from within a program.

The MERGE command combines a program in memory with another program from the disk. MERGE is actually an append, as it does not mix program lines. The line numbers of the program being brought in from the disk must all be greater than the line numbers of the program already in memory.

The TYPE command reads an ASCII file from the disk and displays



it on the terminal one screen at a time. After the first page you have the option of proceeding line by line or screen by screen.

The SIZE command returns the length of a file in bytes. Of course you can always estimate a file's size in kilobytes by dividing its length in blocks by four. This does not take into account the first two bytes of each block which act as a link to the next disk block. An additional error may be introduced by the last block of a file which may not be completely filled. The SIZE command eliminates all these uncertainties. FIND operates by simply reading the selected file and counting every byte till an end of file marker is encountered.

The QUIT command is simple enough. It disables Toolkit and returns its 2½ kilobytes to BASIC.

RAM-Disk

The RAM-Disk utility emulates a floppy disk in a portion of the C-128's built-in RAM. The advantage is of course increased speed. We found that the RAM-Disk was about 30% faster than a 1571 for loading programs. The real speed improvement was in saving programs. For this function we measured a six to one improvement. Of course the greatest benefit would be for users of the 1541 in C-128 mode.

To be properly effective, the RAM-Disk should emulate the disk drive as much as possible. Most Commodore DOS commands are supported. The most notable exception was the lack of relative files. We were also unable to read the RAM-Disk directory with the LOAD "$",9 command. Note that RAM-Disk defaults to device nine. The RAM-Disk directory could be displayed with BASIC 7.0's CATALOG command. The resulting directory listing looked just like that from a real disk drive. The only difference was that the drive number was always an "R" and the disk ID was always RD.

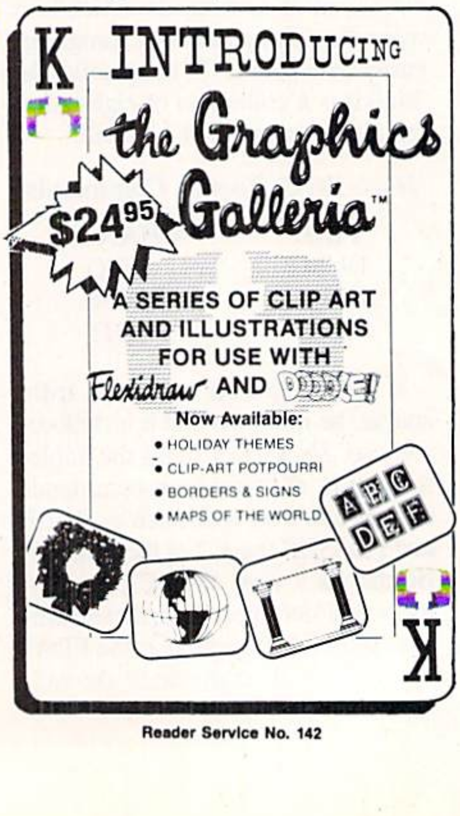


In addition to the standard DOS commands, RAM disk has a set of commands of its own. These control the size of the RAM-Disk and its location in the C-128's memory. The RAM-Disk memory need not be contiguous. It is possible to allocate blocks scattered throughout RAM to the RAM-Disk. Note that RAM-Disk is fixed in size unless specifically instructed to change. It will not automatically expand or shrink in response to the programs it contains.

The default RAM-Disk device number may be changed to suit your requirements. This lets you use RAM-Disk with more than one external drive or even as device number eight. Good disk drive programming practice requires that the disk drive error channel be checked after all disk operations. This is especially true with RAM-Disk, which does not have a blinking error light. An optional debug mode may be turned on to stop a BASIC program when a RAM-Disk error occurs.

Computer RAM is volatile storage. That is, all data is lost when the computer is turned off. Conversely there is no data in RAM when the computer is turned on. For RAM-Disk to be of any use there must be some way to insert and extract data. The simplest way is to load the data into normal RAM and then save it to RAM-Disk. Simply reverse the process to transfer data back to disk. This is fine for program files but distinctly awkward for sequential files. As such RAM-Disk is provided with its own COPY command for transferring files from floppy disk to RAM-Disk and back. Unfortunately, try as we might, we could not get this command to work with our system. All our attempts generated a file not found error on our 1571 disk drive.

Note that in addition to the space required by the RAM-Disk itself, the RAM-Disk program uses up an additional eight kilobytes.



Compressor

Last, and conceivably least, you will find the Compressor utility on the distribution disk. The Compressor exerts its influence upon a BASIC 7.0 program. When it has done its duty, the hapless program will be totally bereft of all REMs and superfluous spaces. In addition, the total number of program lines will be reduced to the extent that logic permits. This is achieved by concatenating program lines and eliminating the superfluous line numbers. The resulting program lines will contain up to 256 tokens and other characters. The whole thing reminded us of our days with a 3½ kilobyte VIC 20. The ostensible purpose of this exercise is to conserve space.

Of course the resulting program lines will be impossible to edit. The resulting program will also be impossible to comprehend. BASIC programmers tend toward spaghetti code even without this sort of encouragement. If you do go in for Compressor, be sure to retain your copy of the original program. Furthermore, in view of the C-128's large programming space, we wonder who would really find a use for this sort of thing. We suppose that anyone who keeps a VIC 20 alongside their C-128 would find this utility a real boon.

Compressor is simple enough to use. Simply copy the intended victim to a disk with some blank space and turn Compressor loose on it. When done you will find the original intact along with the compressed version. We succeeded in turning a 72 line program into a mere 11 lines in a matter of moments. Compressor is a two-pass process. As it functions, the program's original line numbers are displayed. This lets you monitor the program's progress. When done, Compressor displays the vital before and after statistics, which lets you see how well it did.

Compressor will function with the external disk drive or with the RAM-Disk. The latter is recommended for two reasons. First, compressing in RAM-Disk is much faster than on floppy disk. Second, it seems that Compressor does not work with all versions of the 1541 and 1571 disk drives.

Conclusions

Hack-Pack is definitely a useful collection of C-128 utilities. We expect that you will find some of them more useful than others. The Toolkit was certainly a handy thing to have around. The RAM-Disk demonstrated considerable potential. Unfortunately, the RAM-Disk was more potential than performance. The Compressor utility did its job well enough, but we wonder if C-128 BASIC programmers really need such a thing.

Hack-Pack utilizes the color blindness copy protection method: the disk itself is not copy protected, but to gain access to the *Hack-Pack* utilities you will have to correctly identify three color swatches out of a 26 by 40 four color grid. This procedure is implemented every time you boot up. Keep a straight edge handy, as the grid is rather small, the dots are not terribly large, and it is difficult to line up the dots near the center of the array. This program comes with our official bifocal wearer alert.

Distributed by Metacomco, E. 5353 Scotts Valley Drive, Scotts Valley, CA 95066 (phone: in CA 800-GET-META; rest of US 800-AKA-META). *—Morton Kevelson*

POCKET WRITER 2

Digital Solutions, Inc.
Commodore 64/128
Disk; $59.95

Digital Solutions' original word processor for the Commodore 64 was called *Paperback Writer,* but another software company already had a claim to the title. The program was consequently renamed *Pocket Writer.* Their new product *Pocket Writer 2* contains versions of the word processor for both the Commodore 64 and 128. Two C-64 versions are on the disk, one 40- and one 80-column. The 80-column version sacrifices a few features to give the 80-column screen. The C-128 version will only run in 80-column mode, so you'll need the appropriate monitor.

The users manual contains instructions for both versions, with the 128-

specific information highlighted in boxes with blue background coloring. The documentation is minimal. According to Digital Solutions, this is because of the extensive online help functions and the program's ease of use. I could see areas where hardcopy help would have been nice. Also, they should have turned their spelling checker on the manual after writing it, as it contains a number of errors that it might have caught.

Pocket Writer 2 has all the commonly expected word processing functions: insert mode, headers, footers, variable margins and line spacing, justification, right alignment, forced page breaks, and alternate pitch.

Cursor movement is logical. Arrow keys are used to move by character. Arrows in combination with the control key move longer distances. In the C-64 version, this sometimes means pressing three keys simultaneously, which can be troublesome to some typists.

Deleting is done by character, word, sentence, or paragraph. When you hit the key combination for delete you get a prompt asking which kind of delete. You then have to press the appropriate key to delete a character, word, sentence, or paragraph. If word or sentence is chosen, the removed text can be restored in the same place or moved to a new location. This is a quick way to copy or move a word or a sentence. I found this a bit clumsy to use because of the follow-up question. Maybe I'm too stuck on issuing a more specific command and getting immediate execution. You may find their way easier.

The range functions (delete, copy, clear, and move) were useless. When I tried them the computer locked up as I marked the beginning of the range. I could do nothing but turn the computer off.

The printer list is substantial and covers most of the popular printers used with the Commodores. Only a couple of interfaces are mentioned in the manual. The program supports underline, boldface, italic, and sub- and superscripts if the printer supports these features. Alternate pitch, foreign characters and correspondence, or letter quality can be accessed with a little work on the part of the user.

The mail merge function is the equal of most that I've seen. Disk commands parallel those of other commercial programs. *Pocket Writer 2* does offer both ASCII and PET-ASCII and program or sequential file disk saves and loads. This makes it easier to transfer files to and from other word processors or via modem.

Another of the more unusual features is the ability to read in GEOS files. Documents held as text scraps in GEOS can be entered by pressing two keys. The C-128 version includes some enhancements that take advantage of the C-128's larger memory capacity. It works with either the 1350 or 1351 mouse and the two RAM expansion modules. I couldn't test the RAM access, as I don't have an expansion module on hand. You could use a joystick in place of the mouse in the 128 version.

A pull-down menu at the top of the screen offers six sub-menus: files, format, edit, find, print, and spell. The files menu controls disk access chores. Spell, find, and print are self-explanatory. Edit handles copy, move, delete, and clear commands. Format contains most of the commands that are left.

The C-128 version can also address two documents at the same time, so you can compare files and move sections of text between documents more easily. You can also assign a second disk drive as the data drive and not have to enter device numbers each time you access the drive.

Pocket Writer also comes with a spelling checker, but no dictionary for it. You can create your own or buy the $14.95 dictionary from Digital Solutions. The spelling checker is built into the C-128 version, but is a separate program for the C-64. Each unrecognized word is flashed at you and you can either add the word to the dictionary, change the spelling, or skip the word. Changing the spelling requires typing in the new spelling for the word. It's not too bad as Commodore spelling checkers go.

I was disappointed (as I always am) to find that *Pocket Writer 2* is copy protected. The company does offer a backup disk for an additional $13, though.

For those C-64 users who plan to upgrade to the C-128, this might be the best deal around. It costs nothing to acquire the C-128 version. At $59.95, I think it is appropriately priced, though I would be happier if that price included the spelling checker dictionary. If bought as a module in the $99.95 three-in-one pack (including *Pocket Planner 2* spreadsheet and *Pocket Filer 2* database) it's a real deal. Of course, the integration with a database and spreadsheet is only a factor if you have the other two programs.

Digital Solutions, Inc., 2-30 Wertheim Court, Unit 2, Richmond Hill, Ontario, Canada L4B 1B9 (phone: 416-731-8775). *–Cheryl Peterson*

EUPHONY
Precision Peripherals & Software
Commodore 64
Disk; $39.95

Music programs for the C-64 are hardly a novelty. The 64's vaunted SID chip allows the computer to produce a wide range of audio effects of a much higher quality than other 8-bit systems, making it especially popular among binary Beethovens.

Euphony, however, is more serious minded than most such music programs. Unlike software such as *The Music Construction Set* (Electronic Arts), in which the user composes short pieces by clicking on and dragging a preselected note, rest, key signature, etc. to the appropriate position on the staff, music writing on the *Euphony* program is done exclusively in programming terms, by entering data into text files. This method, as the extensive documentation points out, has both advantages and drawbacks. On the plus side, files are much more concise and the program can handle extended compositions. (Program creator Jim Raymond says *Euphony* can store 50 minutes or more of music in a single gulp, a considerable improvement over the two and three minute range of other music writing programs.) Entry in BASIC also permits more extensive manipulation of sequence repeats, tempo modulation, and other features not readily accessible with traditional music composition software.

The downside is fairly obvious: *Euphony* may well hold more appeal for musically inclined programmers than for computer-owning musicians. Although the BASIC programming techniques are pretty elementary, many note-slingers will be put off by such a seemingly nonmusical method of composition.

Euphony is not especially big on the visual gingerbread which makes most mainstream music programs so attractive, either. The main menu screen consists of eight commands (Play, Load, Repeat/Play All, Change Speed, Change Voices, Directory, Change Key, and Return to Basic) and the entry line. The musical scrolling staff and a color-coded (each of the three available voices is assigned its own hue, for easy tracking and playback), 5½-octave keyboard.

Euphony does have lots of impressive features, however, which belie its humble, homemade appearance. There are 16 durations and rests, including four triplets, 32nds, dotted 16ths, dotted whole notes, and ties. Up to 32 variables can be used to define any segment of music, and variables can be nested to a depth of seven levels. This system specializes in providing the user with complete access to all parts of the composition. Its attention to detail is such that each note can be selected as either legato or staccato, and changes can be implemented at any point, as often as the user likes.

The program also offers the standard C-64 music features: three voices, nine instruments (with synthesizer for constructing more), instant transposition, and continuous control over time, key, and tempo, as well as volume, for fashioning crescendos, decrescendos, and sforzandos. Another nice feature is the fact that *Euphony* doesn't make the user wait for

long loads, since everything is entered into the C-64 in RAM at the same time.

For those users not interested in composing original music, *Euphony* offers an extensive library of prerecorded classics and popular favorites (though *Euphony* is definitely oriented toward classical music). Selections include Prokofiev's "Peter and the Wolf," Debussy's "Golliwog's Cake Walk," Mozart's 11th, 16th, and 19th Sonatas, Bach's "Brandenburg Concerto #3," and Tarrega's "Recuerdos de la Alhambra," with "Rock of Ages," "Amazing Grace," and a handful of Christmas carols for non-longhairs. These pieces can be simply played back, or used as the basis for experimentation. By altering the speed, instruments, and key, familiar orchestrations can be modified and even refashioned (try mixing Bach and rock by altering the playback speed on the "Brandenburg Concerto"; or replay Ludwig Von's melodic "Waldstein" at dirge tempo for an experience in audio surrealism).

As selections play back, the appropriate notes are highlighted both on the staff and on the color-coded keyboard, giving *Euphony* an educational dimension; there is something enlightening about "seeing" a musical score play out, note by note. The way in which the individual sounds interweave and overlap to create a new texture is not only instructional, it is quite fascinating.

Euphony is a real working class program; it isn't pretty, but it does a lot more work than most of the glamour software working the same side of the street. What you see is what you get with *Euphony*. Its greatest strength (all music is entered in BASIC, allowing greater flexibility and duration) is also its greatest weakness (all music is entered in BASIC, which is, quite frankly, a drag, unless the user intends to spend considerable time learning the programming system or is already familiar with the language).

Euphony also supports most major printers (Epson FX, MX, Star Micronics Gemini 10, 15, and "possibly others," according to the docs) to produce hard copy of your musical notation. It is also possible to compose a piece of music and give it to friends for playback. The system whereby this is possible essentially removes copy protection from this program; Precision Peripherals & Software take a tremendous leap of faith and request that users only copy music they themselves have written.

As to the quality of the sound itself, it is not going to blow the doors off veteran C-64 music mavens. Most of the compositions are difficult ones, however, designed to show off *Euphony's* powerful music writing capabilities, and in this sense they are quite impressive. It is not unlikely, however, that talented users will be able to produce work of equal or superior quality after a few weeks on this system.

Manufactured by TCO Software, P.O. Box 81504, Fairbanks, AK 99708 (phone: 907-479-4898).

Distributed by Precision Peripherals & Software, P.O. Box 20395, Portland, OR 97220 (phone: 503-254-7855). *–Bill Kunkel*

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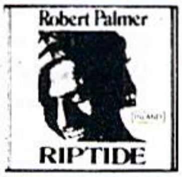












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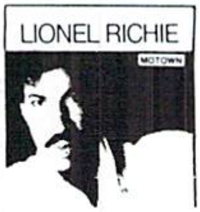
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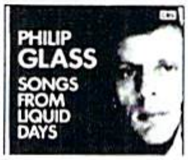
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3 **Pieces Of A Dream,** Joyride
4 **Bob James/David Sanborn,** Double Vision
5 **Yellow Jackets,** Shades

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CENTERING 40 COLUMNS IN 80 COLUMN MODE

Commodore 128 owners know that their 64 programs written in BASIC 2.0 will run without a hitch in the 128's 40-column moide. In 80 column mode, however, the display is unbalanced, with all characters printed to the left half of the screen. The WINDOW command of BASIC 7.0 could correct this easily, but would make the program unusable on a Commodore 64.

The following line is invisible to the 64 and 40-column 128. When using 80 columns, it will give you a perfectly centered display. —Ed Horgan
Coatesville, PA

```
10 IF PEEK(231)=79 THEN POKE 230,21 : PO
KE 231,60
```

C-128 BUG FIX

We will know about the ominous CAPS-LOCK 'q' bug in the C-128. Or do we? In any case, it definitely managed to slip by Commodore. Try it. First switch to lower/upper case mode (so as to better see the problem) by holding down the SHIFT key while depressing the Commodore logo key. Next depress the CAPS-LOCK key and hit the 'Q' key. If you see a lowercase 'q' instead of an uppercase 'Q' then your C-128 suffers from the CAPS-LOCK 'q' syndrome.

If you find that you can't live without the real CAPS-LOCK 'Q' and definitely want your 128 cured of this affliction, the following short routine may save the day for you. Type it in and save it before you run it, as it erases itself after being run. It also steals 89 bytes of RAM memory starting at memory location $1300 (HEX). Once run, the CAPS-LOCK 'q' correction will survive about anything except a cold reset (via the side reset button) and, of course, turning off the computer. —Jim Partin
Cincinnati, OH

```
·10 REM FIX FOR CAPS-LOCK + 'Q' BUG ON C1
28
·20 REM BY JIM PARTIN (8/19/86)
·30 REM COPY CAPS-LOCK DEF. TABLE INTO RA
M
·40 FAST
·50 FORT=1TO89:POKEDEC("1300")+T,PEEK(DEC
("FBE4")+T):NEXTT
·60 POKE840,DEC("00"):POKE841,DEC("13"):R
EM CHANGE TABLE POINTERS
·70 POKEDEC("1300")+62,209:REM FIX!
·80 SLOW:END
```

PASSWORD

Do you have BASIC programs that you would like to protect from prying eyes? Do you own a C-128? Are you reading this line? If you answer yes to all of the above questions, do I have a utility for you. *Password! Password* will protect your programs by taking a code that you select of up to 160 characters and scrambling the program so the only way to use it is to unscramble it using the same code. Now, in order for someone to use your program, they must know the password!

There are many ways to utilize this program, but the procedure I prefer is outlined below.

First, run PASSWORD.CRE so it can create an ML file on disk using the name "PASSWORD.ML". Next, BLOAD"PASSWORD.ML" and then load the program to be protected. Enter SYS 5555,0 and type a password (code) of up to 160 characters for the program. This password is used to scramble the program. Be patient: it may take a couple of seconds. When the cursor reappears, LIST the program. As you can see, only the first line is visible. Don't let this fool you—the program has been scrambled. Now save your protected program. Any time you load the protected program from disk you must unprotect it. To unprotect the program BLOAD"PASSWORD.ML", SYS 5555,1, and provide the same password you used to scramble the program. Again, in a matter of seconds your program is unprotected. What I do, since the first line is not scrambled, is save a copy of PASSWORD.ML on every disk that I have protected programs on, and before scrambling each program I make the following line the first line of each program:

```
0 BLOAD"PASSWORD.ML":SYS 5555,1
```

Now, a sample RUN"filename" loads the protected program and the program to unprotect it. The BASIC program will continue to run after it has been unprotected.

A Syntax Error will likely be displayed with this program when called from direct mode. Nevertheless, you can be sure that the program has done its job.

—Shawn K. Smith
Bronx, NY

```
·100 REM* PASSWORD.CRE FOR BASIC PROGS.
·110 REM* (A) SHAWN K. SMITH PRODUCTION
·120 DATA 48,A2,00,8E,00,FF,20,7D,FF,50
·130 DATA 41,53,53,57,4F,52,44,3F,20,00
```

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```
•140 DATA 20,93,4F,AD,00,02,F0,31,A0,00
•150 DATA B1,2D,85,C2,85,C4,C8,B1,2D,85
•160 DATA C3,85,C5,A9,00,AA,A8,C8,B9,FF
•170 DATA 01,F0,F6,41,C2,81,C2,E6,C2,D0
•180 DATA 02,E6,C3,A5,C2,CD,10,12,D0,E9
•190 DATA A5,C3,CD,11,12,D0,E2,A0,00,68
•200 DATA 91,C4,C8,91,C4,4C,4F,4F,EA
•210 S=5555:FORD=STOS+88:READY$:V=DEC(Y$)
•220 T=T+V:POKED,V:NEXT:T=T-11567
•230 PRINT:PRINT:PRINT:POKE243,9
•240 IFTTHENPRINT"?ERROR -CHECK DATA":END
•250 INPUT"PRESS RETURN TO SAVE FILE";Y$
•260 BSAVE"PASSWORD.ML",B0,P (S)TOP (D)
•270 PRINTDS$:END: SAVE IT, NOW!
```

THE MISSING DOS COMMAND

The DOS commands on the C-128 are a very welcome addition to Commodore BASIC. One very helpful command was overlooked: a command that would let you view a sequential file. If you are looking at BBS document files or are writing a program, this command will be very useful.

```
READ#1fn,"filename"[,U device #]
```

You can use the NO-SCROLL key to pause the listing, any key to restart, and the RETURN key to abort the listing.

This command can be used in a program to display instructions or in immediate mode to look at help screens for programming. It will not erase any memory, so you don't lose your basic program.

After running this program you have a file on disk called 'READ#.COM'. You can use BOOT"READ#.COM" or SYS 4864 to start it and SYS 4957 to stop it. The RUN STOP/RESTORE combo doesn't disable it. Add this command to your autoboot start-up routine and it will be there when you need it. —Don Harkness
Andover, KS

```
•100 REM C-128 READ#.BAS
•110 REM BASIC LOADER FOR READ#.COM
•120 FOR X=4864 TO 4968:READ A:POKE X,A:N
 EXT X
•130 BSAVE"READ#.COM",B0,P4864 TO P4969
•140 NEW
•200 DATA 169,11,141,0,3,169,19,141,1,3,9
 6,224,11,208,23,201,35,208
•210 DATA 19,165,61,233,1,133,38,165,62,2
 33,0,133,39,32,192,3,201,135
•220 DATA 240,3,76,63,77,32,29,161,165,18
 4,141,104,19,32,183,255,41,64
•230 DATA 208,28,173,104,19,170,32,198,25
 5,32,228,255,176,16,32,210,255,32
•240 DATA 204,255,32,228,255,201,13,240,3
 ,76,49,19,173,104,19,32,195,255
•250 DATA 76,144,175,169,63,141,0,3,169,7
 7,141,1,3,96,0
```

ROM BUG

The Commodore 1571 has a bug in ROM. It's more annoying than destroying. If a disk is HEADERED in the double sided mode, and has less than 664 sectors allocated, then validated in the single sided mode (64 mode)...guess what? You come out with a single sided disk. The validation process rewrites a byte on the disk when in single sided mode. If you have programs past sector 664 they will survive, since an illegal track and sector error will occur, stopping the validation procedure. Yet who wants to recopy 70 or so programs to a double sided disk? Not me. So here is a cure. What this program does is change the double-single sided status flag at track 18, sector 0, byte 3 on the disk.

Warning! Use only on disks that have been HEADERED as double sided. If you run this program by mistake on a single sided drive (1541) it will have no effect, since a single sided drive ignores this byte. Be extremely careful when typing in this program; one mistake can trash a disk! Try it on a test disk first...please. —Barri Olson
Madison, WI

```
•10 REM 1571 DOUBLESIDED SAVER - AFTER VA
 LIDATE IN 64 MODE
•20 OPEN15,8,15:OPEN5,8,5,"#":PRINT#15,"U
 1";5;0;18;0:PRINT#15,"B-P";5;3
•30 PRINT#5,CHR$(128);:REM SET TO 0 FOR S
 INGE SIDED- 128 FOR DOUBLE SIDED ***
•40 PRINT#15,"U2";5;0;18;0:PRINT#15,"I0:"
 :CLOSE5:CLOSE15
```

BACK TO BASICS

Taking a BASIC program and saving it as a sequential text file has many advantages. Many word processors have features such as SEARCH/REPLACE and FIND, just to name two, that can be used on a BASIC program if saved as a sequential file. Furthermore, editing a sequential text file is usually very easy with WP programs which offer bidirectional scrolling. Still another benefit is the ability to have many small routines (utilities/programs) saved as sequential text files and merging them into one BASIC program. Changing a BASIC program already in memory to a text file requires only two entries:

```
1) OPEN8,8,8,"filename,S,W":CMD8:LIST

2) PRINT#8:CLOSE8
```

(Note: Some WP programs save text files as PRG and not SEQ. If you have one of these WP programs, change the S to P.)

The program below will translate a text file back to BASIC. This program can easily merge text files with any BASIC program in memory. As listed, the program will work with the VIC and 64. But, by changing the value of B (842 for C-128) and K (208 for C-128), it should work on other Commodore computers that have the dynamic keyboard feature (PET,+4,16). Run the pro-

gram (RUN 6) and enter the name of the text file. As the text file is being merged, the lines will appear on the screen. When the program is finished, a SYNTAX ERROR might be displayed, which is natural. After all the routines you want to add have been merged, remember to delete *Back to BASIC.* —Shawn K. Smith
Bronx, NY

```
•60000 INPUT"FILENAME";A$:OPEN8,8,8,A$
•60050 GET#8,A$,A$:REM ID. BACK TO BASIC
•60100 B=631:K=198:POKE152,1:PRINT"[CLEAR
 ][3"[DOWN]"]"
•60125 FORD=1TO0STEP-ST:GET#8,A$:PRINTA$;
•60200 IF A$=CHR$(13) THEN 60400
•60300 NEXT:CLOSE8:END
•60400 FORD=0TO6:POKED+B,13:NEXT:POKEK,D
•60500 PRINT"[4"[DOWN]"]GOTO60100[HOME]":
 END
```

FREE.HELP

For those of you who hate dishing out $30 for a manual (which you can't understand anyway), here is a real money-saver. Believe it or not, there is a CP/M manual on your CP/M disk already. To get it, type in the following for your appropriate drive and follow the prompts. If you don't have a 1571 you will have to put up with a few pages of garbage at the beginning, but otherwise it is the same as the manual you get if you have a 1571. The reason for this is that the Help.HLP file is 83K, Help.DAT is 82K, and Help.COM is 7K which is over the 170K limit of the 1541. When using the 1571 method, you have to have a disk just formatted in 128 double-sided mode. To get a nicer printout with either drive set your printer to skip-over-perfs.

1541 Disk Drive (with the CP/M disk in drive A)
A> pip lst:=help.hlp
1571 Disk Drive (with the CP/M disk in drive A)
A> pip e:=a:help.* **(E: is the newly formatted disk)**
A> help [extract]
A> pip lst:=help.dat
1571 and Another 1571 or 1541 Drive (with the CP/M disk in drive A: and the newly formatted disk in drive B:)
A> pip b:=a:help.*
A> help [extract]
A> pip lst:=help.dat

—Paul Reeves
Hamilton, ONT

SILVER SCREEN

Here's a special effect which creates the illusion of an old-time movie reel on your computer screen. This special effect is especially suitable for setting the mood for an arcade game or slide show set in the "silver screen" era. This effect will run in conjunction with BASIC programs and machine code programs that don't alter the IRQ interrupt vector.

After saving a copy of *Silver Screen*, run it. The loader will check for errors in the data and then POKE the

machine language data into memory. (Memory locations 679-740, to be exact.) When you wish the effect to begin, simply enter:

```
SYS 679
```

The RUN STOP/RESTORE keys will stop the effect. *Silver Screen* is an excellent example of how short, uncomplicated machine code routines can be used to painlessly spice up BASIC programs. —Bob Ash
Poteau, OK

```
·1000 REM ******************************
·1010 REM * SILVER SCREEN, BY BOB ASH *
·1020 REM ******************************
·1030 :
·1040 REM ** CHECK FOR DATA ENTRY ERROR *
 *
·1050 S=0:FOR I=679TO740:READ MC:S=S+MC:N
 EXT
·1060 IF S <> 5744 THEN PRINT "ERROR IN D
 ATA":END
·1070 REM ** POKE MC INTO MEMORY **
·1080 RESTORE
·1090 FOR I1=679 TO 740: READ MC: POKE I1
 ,MC: NEXT: POKE53281,11
·1100 END
·1110 DATA  169, 0, 141, 54, 3, 120, 169,
 185, 141, 20, 3
·1120 DATA  169, 2, 141, 21, 3, 88, 96, 2
 38, 54, 3
·1130 DATA  173, 54, 3, 201, 1, 240, 16,
 201, 10, 240
·1140 DATA  20, 201, 11, 144, 21, 169, 0,
 141, 54, 3
·1150 DATA  24, 144, 13, 169, 0, 141, 32,
 208, 24, 144
·1160 DATA  5, 169, 15, 141, 32, 208, 76,
 49, 234, 141
·1170 DATA  52
```


SPC COMMAND UNLEASHED

If you've done much programming at all on your 64, I am sure you have longed for a command that would print a given number of blank (or reverse) spaces instantly on the screen, to create attractive bar graphs, or blank parts of the screen, or fill boxes with reverse spaces.

On most computers, the SPC command does exactly this. However, on Commodore computers, this only generates a number of cursor rights on the screen, leaving the characters it crosses untouched.

Well, a little gimmick using the Kernal ROM alleviates this problem, and adds a new and very useful command to BASIC.

All you have to do is open a channel to the screen as if it were an output device! Using this method, any SPC command will generate an appropriate number of CHR$(32)'s, in either REVERSE-ON or REVERSE-OFF.

If you use this command in combination with POS(0), you can compute and print "clear to end of logical line" commands like the C-128's ESC code, or clear parts of the screen and leave the rest intact. It is superior to the Kernal ROM's much-touted clear line routine in that it can be used to clear only a portion of the line it is on.

The short little program below demonstrates use of this command to make attractive, graphically interesting bar graphs almost instantaneously, rather than using FOR-NEXT loops. Note that a REVERSE-ON character must be printed at the beginning of each bar, and a CHR$(13) to move it to the beginning of the next line.

Make sure that your program closes the channel properly as shown when you want to return to normal screen output. —Cleveland M. Blakemore
Richmond, VA

```
·10 POKE53281,.:POKE53280,.:PRINTCHR$(147
 )TAB(10)"EASY BAR GRAPHS!"
·20 OPEN1,3:CMD1
·30 FORG=1TO18
·40 X=RND(1)*38+1:C=RND(1)*14+1
·50 POKE646,C
·60 PRINTCHR$(145)CHR$(18)SPC(X)CHR$(13)
·70 NEXT
·80 PRINT#1,""
·90 CLOSE1,1
```

Turtle Graphics, COMAL, and Logo

By Richard Herring

Take a small step. Turn right a little. Repeat those commands over and over. You have just taken the first step (oops, sorry) in exploring turtle graphics. This column will take you another step.

Turtle geometry differs from other types of geometry in that it is dynamic, or process-oriented. A circle in Cartesian geometry is a set of points that makes an equation come true. A circle in turtle geometry is defined by thinking about what the turtle must do to move along the circle.

Back in 1982, a friend gave me a version of the microcomputer language Logo. He knew I was interested in the educational uses of micros as well as in artificial intelligence. Logo provided a perfect environment to explore those interests.

It was mid-1983 when I finally emerged from my Logo experience. Logo was captivating. It seemed to exist just to make exploring with the computer easy. Logo, which is Greek for "word" or "thought," was developed by Seymour Papert, an educator at MIT who had closely studied the child development theories of Jean Piaget.

Papert had realized that computer languages in the 60s and 70s were designed to be simple for computers, not easy for humans. The fact that early BASICs had a few primitive commands did not make learning to program easy. It meant that you had to write your own routines for many of the commands that we take for granted today. Programming languages were designed to use as little RAM and as few clock cycles as possible.

To avoid those worries, Logo was developed on the most sophisticated computers available and modeled after the AI language LISP (for LISt Processing). As it emerged, Logo found six strengths. First, programs are written in small blocks of code or procedures, as with COMAL and Pascal, rather than in one huge chunk. Second, programming is interactive. Like BASIC or COMAL, as soon as you type a command, the computer obeys it. Interactive languages usually make programming easier, although completed programs may run faster in non-interactive languages.

Third, Logo, like COMAL, is recursive. A procedure can be used as a subprocedure of itself. Recursion is particularly important for describing complicated mathematical problems in simple versions of themselves. Fourth, Logo is extensible, allowing user-defined procedures to be used like primitive commands. Fifth, Logo variables do not have to be declared as string or numeric. Sixth, Logo has list processing to group individual bits of information into sets. COMAL, like BASIC, uses arrays. A list is often considered more flexible than an array because a list has no fixed size and can contain words, numbers, or even other lists as elements.

Aside from its AI-like lists, the most obvious and intriguing feature of Logo is turtle graphics, a feature conveniently available to all you COMAL programmers. With your indulgence, we will spend the next couple of months exploring with turtles and, in the process, learn something about COMAL graphics.

Turtle graphics are deceivingly simple. The turtle appears as a triangle on the screen. He has a line from his middle to one corner—his head. The turtle does two things: he moves and he draws. To move him you command FORWARD(x), LEFT(y), or RIGHT(y), where x is the size of his step and y is the number of degrees to turn. Typing FORWARD(20) and LEFT(144) five times will draw a star.

COMAL is required to run the program included with this article. Version 0.14, which will run the program when the indicated modifications are made, can be found on this month's *Ahoy! Disk* (see page 60).

If you want the star to be a particular color, you give the turtle the PENCOLOR(#) command, where # is any of the Commodore color codes from 0 through 15. The PENUP command tells the turtle not to draw as he moves. PENDOWN will tell him to start leaving a trail again.

Let's do a short 45 line program that will show how to set up a turtle graphics screen, give you some idea of the variables to control, and produce some spectacular results. We will use line numbers even though COMAL doesn't require them, so the program is easy to follow.

The program is just three procedures:

```
10 questions
20 setup
30 drawit
```

The "questions" procedure asks you for 7 numbers. You specify the distance you want the turtle to go (line) and the number of degrees he should turn at the end of that distance (angle). You also have the option to increase the

Special Program Notes

1) In the "setup" procedure, line 270 sets the graphics screen to 0 for the standard high resolution bit map mode. The other possible value is 1 for the multicolor bit map mode. The standard mode gives you a screen of 320 horizontal dots by 200 vertical dots, while the multicolor mode only gives you 160 by 200 dots.

But high resolution has a disadvantage if you use the option to have your graphics created in several colors. The standard (hi-res) mode allows only two colors in each 8 by 8 dot section. If a line with a third color crosses through one of those sections, the third color will fill the whole 8 by 8 section. If you want colorful graphics to be sharper, you may actually like the low resolution (multicolor) mode better. It allows up to four colors in each 8 by 8 dot section of the bit mapped screen.

2) Also in line 270, for version 0.14 users, the "setgraphic 0" command will show two text lines on the top of the screen. If you don't want them, you'll have to add a "fullscreen" command at line 275.

3) Lines 270 and 290 prove some of the additional power of version 2.0. In version 0.14 you must set turtlesize before giving the "setgraphic" command or "setgraphic" will kick the turtle back to his maximum size of 10. Version 2.0 doesn't care what order these two commands come in. Also note that the command "hideturtle" is equivalent to turtlesize(0).

4) In lines 70, 90, 110, 130, 150, 170, and 190, we use version 2.0's fancy "input at" command to position the cursor over the default answers in the preceding "print" statements. How and why this works, I'll save for a whole column on getting user inputs.

5) Line 440 is where the procedure "drawit" calls itself. A language is procedural if one procedure can do part of its work by calling another procedure. That language becomes recursive if the procedure can be a subprocedure of itself. Among modern procedural languages, only FORTRAN allows procedures but not recursion. The procedure "drawit" uses tail recursion, where the recursive use of "drawit" is the last thing done in the procedure.

Tail recursion, typically, can be done just as easily iteratively. Iteration means simply telling the computer to execute something repeatedly. BASIC's FOR/NEXT command is a good example. Iteration is often preferred over recursion because, in many implementations of computer languages, it is faster and uses less memory. The interpreter in some newer languages recognizes tail recursion and treats it like iteration.

Recursion, since it can refer to itself, can also refer to itself referring to itself. In human terms this is as complex and fascinating as when you think about thinking. This kind of self-reference finds its roots in the history of philosophy. Remember the Greek paradox about the liar from Crete. If all Cretans lie, but our Cretan says "I'm lying," isn't he really telling the truth?

distance or angle by a specified increment (lineinc or angleinc) during each loop through the "drawit" procedure. You set the screen color (backcolor) and tell the turtle how many different color pens to use (numcolor).

Finally, the questions procedure asks you for the variable "repeat." If you choose to give a non-zero value for "repeat", you will want to use the default values of 0 for line increase and angle increase. "Repeat" increases the length of each line the turtle draws by the original length. This incremental change occurs the number of times you specify in "repeat", then the line length is reset to the original value. "Repeat" merely scratches the surface of the kinds of recursive patterns you can design.

```
40 PROC question
50   PAGE // 0.14=PRINT CHR$(147)
60   PRINT "Starting line length: 40",
65   // 0.14 must delete 'at #,#,#: "":'
70   INPUT at 0,23,5: "": line
80   PRINT "Starting angle size: 144",
90   INPUT at 0,22,5: "": angle
100  PRINT "Increase each line by: 0",
110  INPUT at 0,24,5: "": lineinc
120  PRINT "Increase each angle by: 0",
130  INPUT at 0,25,5: "": angleinc
140  PRINT "Background color (0-15): 6",
150  INPUT at 0,26,2: "": backcolor
160  PRINT "How many colors (0-15): 1",
170  INPUT at 0,25,2: "": numcolor
180  PRINT "Repeat (0-10,complex): 0",
190  INPUT at 0,24,2: "": repeat
200 ENDPROC questions
```

The second procedure sets up the turtle graphics screen. The "use turtle" command tells the cartridge version of COMAL that turtle instructions are on the way. In version 0.14, it is not necessary to initialize certain command sets with "use", but 0.14 also has far less memory available for your program. Next we clear the turtle's screen and set the screen color. "Home" tells the turtle to move to the center of the screen facing up, though on a new screen like this, that's where he will start anyway. Next we select the high resolution graphics screen to give your artistic creations the best possible resolution.

The "wrap" command connects the bottom of the screen to the top and the left side to the right side to make a two-dimensional globe. If the turtle runs off the top of the screen, you won't have to imagine what his graphics would look like on the wall. Instead, he will reappear

on the bottom of the screen. "Turtlesize(#)" specifies how big the turtle (triangle) should be. Our setting of 0 makes the turtle invisible so we won't see him redrawing simple graphics. And finally, we set the initial values for the pen color and the "count" variable used by "repeat".

```
210 PROC setup
220   USE turtle // 0.14 omit
230   clearscreen // 0.14=CLEAR
240   border(backcolor) // 0.14 omit ()
250   background(backcolor) // 0.14 omit ()
260   home
270   graphicscreen(0) // 0.14=SETGRAPHIC 0
280   wrap // 0.14 omit
290   turtlesize(0) // 0.14=omit ()
300   pclr:=1
310   count:=1
320 ENDPROC setup
```

The last procedure, "drawit", does all the real work by calling itself over and over. Note the last command in the procedure (line 440) puts "drawit" in an endless recursive loop. Lines 400-430 just change the color of the turtle's pen as many times as you specified and check that the pen color is not the same as the background screen color. At lines 340-390, the turtle moves forward and turns according to the values you gave.

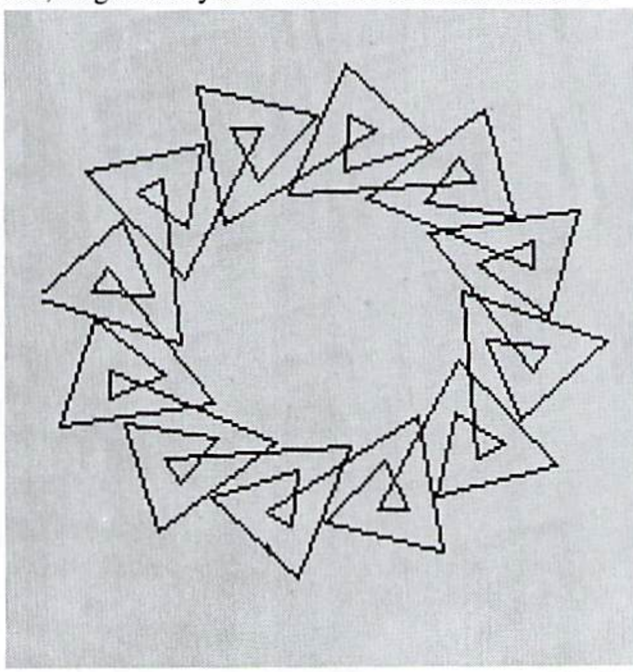
```
330 PROC drawit
340   forward(line*count)
350   right(angle)
360   count=count+1
370   IF count>repeat THEN count=1
380   line:=line+lineinc
390   angle:=angle+angleinc
400   pencolor(pclr)
410   IF pclr<=numcolor THEN pclr:=pclr+1
420   IF pclr>numcolor THEN pclr:=1
430   IF pclr=backcolor THEN pclr:=pclr+1
440 drawit
450 ENDPROC drawit
```

Just to get you started, try some of these sets as inputs to the turtle:

[1,88,1,0,6,1,0]	[12,88,0,0,6,1,5]
(1,180,0.1,9,6,1,0]	[10,144,0,0,6,1,8]
[20,2,0,20,6,1,0]	[10,225,0,0,6,1,10]
(18,40,0,30,6,1,0]	

If you're interested in the educational aspects of computers, and turtles in particular, you might want to check out Papert's book *Mindstorms, Children, Computers, and Powerful Ideas.* Or if you want to know just how complex a critter that little turtle can be, try the book *Turtle Geometry: The Computer as a Medium for Exploring Mathematics* by Abelson & diSessa.

Next month we'll explore more concepts of turtle graphics. We'll also look at some non-turtle COMAL commands that will let us develop a simple joystick drawing program that, through the addition of procedures you can add, might take you to the land of microworlds. ☐



The result of inputting 10,245,0,0,6,1,6 into the COMAL turtle graphics program provided on these pages.

Reader Service No. 117

EXTENDED BACKGROUND MODE

For the C-128

By R. Harold Droid

Among the features of Commodore's 40-column graphics (VIC) chip is a text mode called extended background color mode. Not supported by any of the 128's BASIC 7.0 commands, this mode lets you put different background colors behind individual characters. Now you can add those commands yourself and put this "bonus" mode to work in your own programs.

Type in the program. Remember to save it before you run it, as a hedge against disaster. Running the program POKEs some code into an unused part of memory and enables the new keywords. You can use this program as a subroutine within your own program, or just experiment with it in direct mode for now. If you do the latter, you can type NEW after running to clear BASIC program memory. The commands stay in the machine until you use the reset button or turn off the computer.

Here are the new commands:

EXTON turns extended background text mode on. Standard C-128 graphic modes are disabled; the GRAPHIC command has no effect while the new mode is active.

EXTOFF turns extended background text mode off and returns to standard text mode (GRAPHIC0).

EXTCOL selects colors. Four different background colors can be displayed on the screen at any one time. The syntax is

```
EXTCOLc1,c2,c3,c4
```

where c1-c4 are standard C-128 40-column color codes (numbers 1-16). Color c1 is the screen background. The system has default values built in if you don't specify otherwise with this command.

EXT switches between the four colors. The syntax is

```
EXTn
```

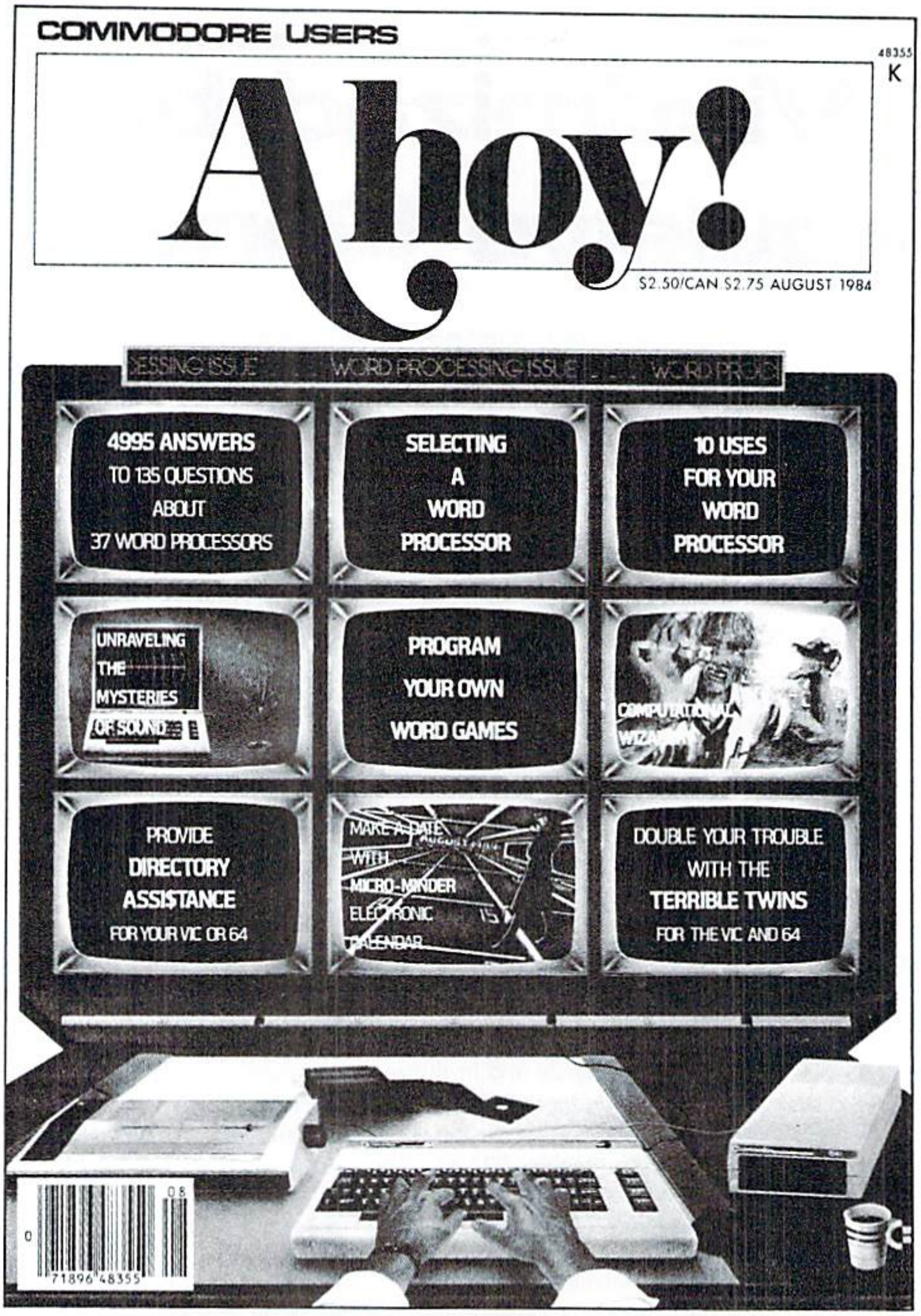
where n is a number from 1-4 that corresponds to colors c1-c4. It defaults to color c1. Once you've chosen a color with EXT, all subsequent PRINT statements print in that background color until you change it with another EXT command.

Extended background text mode trades a reduced character set for an increase in background color choices. The normal character set consists of the following subsets of screen codes: screen codes 0-63 are unshifted characters; 64-127 are shifted characters; 128-195, unshifted, reversed characters; 196-255, shifted, reversed characters. Only the first 64 characters can be displayed in extended background color mode. This limits you to numbers, punctuation marks, and unshifted alphabetic characters. Note that the alphabet can be either upper- or lowercase, depending on which character set has been selected with the COMMODORE/SHIFT key combination.

The three higher subsets of screen codes, instead of displaying shifted or reversed characters, now display the three additional background colors. While you're in extended background mode, entering shifted alphabetic or reversed characters from the keyboard may not give you the characters or the colors you would expect. Use the EXT command and limit your PRINT strings to the allowed characters and you've got an easy, predictable way to put extended background mode to work for you in your programs. Standard control characters, such as foreground color changes, CLR and HOME, and cursor movement work normally within your PRINT statements. But except for purely experimental reasons, leave RVS ON and RVS OFF alone.

Some of the effects of extended background color mode are quite novel, like a red cursor printing out white characters, or program listings in multiple colors. Playing around with this in direct mode can be a great way to have a little fun, to gain insight into how the printing routines turn ASCII into screen codes, or to drive yourself crazy. Remember, this mode is recognized by the video display chip—not by the BASIC editor. When you're trying to do some serious editing, use EXTOFF to preserve the normal environment—and your sanity. ☐

SEE PROGRAM LISTING ON PAGE 105



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LIST FORMATTER

For the C-128

By Shawn K. Smith

List Formatter is a utility designed for the Commodore 128 which greatly increases the readability of BASIC programs. As the owner of a C-128, you are probably aware that the BASIC editor has an input buffer which allows you to enter BASIC lines of up to 160 characters in length. This is a big improvement over the C-64's capacity of 80 characters per line. The larger buffer means that we can enter twice as much information on a single line. And, since packing multiple commands on one line can actually increase the speed of BASIC program execution, programmers are taking full advantage of the input buffer. Unfortunately, however, this quest for increased speed has produced a predicament. Many programmers find themselves asking, "Should I throw readability out the window and settle for the increased speed?" My answer is simple. NO! Use *List Formatter* and get the best of both worlds.

List Formatter is a short machine language program in the form of a BASIC loader. There are no special instructions for typing in the program. Enter it as you would any BASIC program, but pay close attention to the DATA statements which contain the ML code. After you've typed in the program, save a copy. When you run it, the ML is POKEd into a safe area of RAM which is determined by the value of the variable S. If you wish, you can have the program relocated by changing the value of S in line 110 before you run it. Next, the program is activated, the SYS to turn it on/off is displayed, and the loader is erased from memory.

Now that *List Formatter* has been patched into the IQPLOP vector (306-307), which is responsible for listing BASIC text, we are able to control the way BASIC lines are listed. (It should be noted that the LIST command has not been changed, only the format of the listing.) Since the only way to place multiple statements on a line is to use a colon, *List Formatter* first checks for colons. When a colon is encountered, the program makes sure that the colon is not within quotes. If this turns out to be true, a carriage return and a calculated number of spaces are printed to produce a uniform output. Likewise, in keeping with readability, all REMs are displayed in reverse video! As an example, consider listing the following BASIC line:

```
200 GOSUB500:DO:READY: IF Y<0THEN
EXIT:ELSE:PRINT#8,CHR$(Y)+":";:LOOP:REM
STORE DATA TO DISK!"
```

With the standard list routine, the line would list as is. However, with *List Formatter* the listing becomes

```
200 GOSUB500
    :DO
    :READY
    : IF Y<0THEN EXIT
    :ELSE PRINT#8,CHR$(Y)+":";
    :LOOP
    :REM STORE DATA TO DISK!
```

This format is ideal for examining programs, or as a final draft of your program. But do not attempt to edit a line in this format. If you must edit a line, temporarily turn off *List Formatter* and relist the line. Removing the REM from the beginning of line 350 in the BASIC loader will turn the f5 function key into an on/off switch for *List Formatter.*

I hope this program proves to be as beneficial for you as it has for me. ☐

SEE PROGRAM LISTING ON PAGE 113

COMMODARES
PROGRAMMING CHALLENGES
By Dale Rupert

Each month, we'll present several challenges designed to stimulate your synapses and toggle the bits in your cerebral random access memory. We invite you to send your solutions to:

Commodares, c/o *Ahoy!*
P.O. Box 723
Bethel, CT 06801

We will print and discuss the cleverest, simplest, shortest, most interesting and/or most unusual solutions. Be sure to identify the *name* and *number* of the problems you are solving. Also show sample runs if possible. Be sure to tell what makes your solutions unique or interesting, if they are.

Programs on diskette (1541 format only) are welcome, but they must be accompanied by listings. You must enclose a stamped, self-addressed envelope if you want any of your materials returned. Solutions received by the middle of the month shown on the magazine cover are most likely to be discussed, but you may send solutions and comments any time. Your original programming problems, suggestions, and ideas are equally welcome. The best ones will become *Commodares*!

PROBLEM #40-1: SMALL STRAIGHT

This problem was submitted by Steven Steckler (Columbia, MD). In his Yahtzee game program, Steven randomly tosses five dice and then tests for a small straight. For this program, small straight means that at least four of the five dice can be arranged to be in numerical order.

For example, a toss of 61534 represents a small straight since there is a "3456" sequence among them. Also 53542 contains "2345", 41342 contains "1234", and 51234 contains both "1234" and "2345." How easily can you simulate the throw of five dice and identify those throws which contain one or more small straights?

PROBLEM #40-2: SHORT SORT

Chris Raimondi (Kingsville, MD) needs a program in which the user enters six numbers and the computer prints them out in numerical order. Disregarding the input statement, can you program the sorting routine in just one line? If not, send your shortest routine anyway.

PROBLEM #40-3: POLYGON PLAY

Nolan Whitaker (Jeffersonville, KY) suggested this geometrical challenge. The user enters the number of sides of a regular convex polygon (3 is an equilateral triangle, 4 is a square, 5 is a regular pentagon, and so on). The program responds with the size of each interior angle, the sum of its interior angles, the area of the polygon, the radius of an inscribed circle, and the radius of a circumscribed circle, assuming each side of the polygon has a length of one meter.

PROBLEM #40-4: INTEGER FUNCTIONS

Create user-defined functions FNF(X) and FNC(X) which determine the floor function and the ceiling function of any input value X. The floor function of X is defined as the greatest integer less than or equal to X. The ceiling function of X is the least integer greater than or equal to X. For example if X is 3.5, FNF(X) is 3, while FNC(X) is 4. If X is −3.5, FNF(X) is −4, and FNC(X) is −3. Let's see some solutions from you first-timers.

This month we will look at the most interesting solutions to *Commodares* from the December 1986 issue. One tip and a suggestion first. If you send a disk (1541 format only), be sure to pack it between pieces of cardboard or put it in a special disk mailer. Also mark the outside of the package "Please Do Not Bend."

The reason for this warning is that my mailbox often fills to overflowing, and sometimes the larger envelopes are folded to fit in. The envelopes properly labeled are usually left flat, and the disks in them tend to work much better than those with a crease down the middle. Remember to send packaging and return postage if you want any materials returned. (With prices of disks below $1 these days, the return postage is usually more than the disk. It's your option.)

Now for the tip. If a damaged disk does not rotate freely in its jacket (such as those I receive with creases), it is still possible to salvage the data on it. Carefully open the jacket at one end and slip the disk out (touch the edges, not the writing surfaces). Remove the inner disk from another diskette which has a good jacket and replace it with the disk from the damaged jacket (be sure it is right side up). Now you can read and copy the files from the damaged disk.

One final note. Amazingly enough, some disk drives which are not spring-loaded allow the inner disk itself to be inserted and read even *without* its jacket. (This is not a recommended procedure, of course, but it works.) The spring-loaded drives such as the 1541 and most other half-height drives require the strength of the jacket to cock the spring before the disk can be inserted, however. Enough for disk trivia.

Determining the 2,568 digits of 1000 factorial (1000!) was the challenge from *Problem #36-1: Fancy Factorials*

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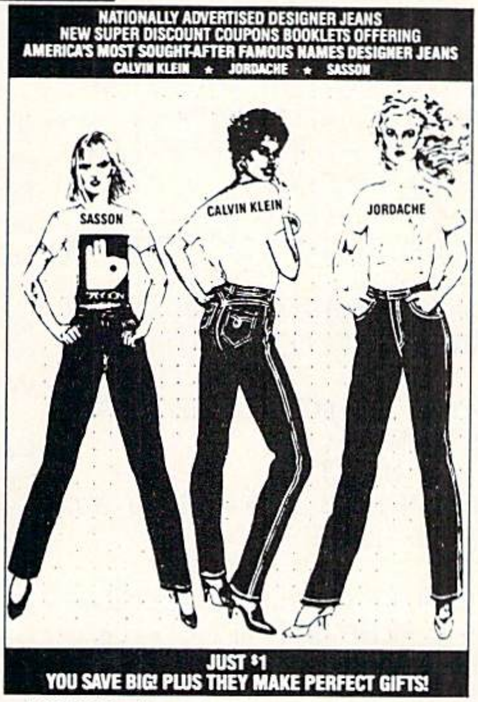
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suggested by Jim Speers (Niles, MI). Several readers met the challenge. N factorial is the product of all integers from 1 up to and including N. 5! is 5*4*3*2*1 or 120 (not 720 as given in the original example). As David Hoffner (Brooklyn, NY) pointed out, the challenge was not so much the calculation, but where to fit the digits in the computer. David used two arrays to store the digits. The following program is a collection of several solutions to the problem.

```
·1 REM ===================================
·2 REM    COMMODARES PROBLEM #36-1 :
·3 REM    FANCY FACTORIALS
·4 REM
·90 REM----SOLUTION BY MATT SHAPIRO------
·100 H=100000:E=.0000001:I=0:J=0:K=1:C=0:
 P=0:N=0:DIMF(3000):F(1)=1:INPUT"N";N
·110 FOR I=1 TO N:FOR J=1 TO K:P=I*F(J)+C
 :C=INT(P/H+E):F(J)=P-H*C:NEXT
·120 IF C THEN K=K+1 : F(K)=C : C=0
·130 NEXT:PRINT MID$(STR$(N),2)"!="MID$(S
 TR$(F(K)),2);
·140 IFK>1THENFORJ=K-1TO1STEP-1:PRINTRIGH
 T$("[4"0"]"+MID$(STR$(F(J)),2),5);:NEXT
·150 END
·190 REM----SOLUTION BY ROB SCHULTZ------
·200 INPUT "N";N : M=1
·210 FOR J=1 TO N : M=M*J
·220 IF M>=10 THEN M=M/10 :E=E+1:GOTO 220
·230 NEXT : PRINT M "E+" E
·240 END
·290 REM---SOLUTION BY CHARLES KLUEPFEL--
·300 INPUT "N";N : PRINT N"[LEFT]! = ";
·310 LN=LOG(N)*(N+.5)-N+LOG(2*[PI])/2+1/(
 12*N)-1/(360*N*N*N)
·320 LN=LN+1/(1260*N*N*N*N*N)-1/(1680*N*N
 *N*N*N*N*N)
·330 IF N<12 THEN PRINT INT(EXP(LN)+.5) :
  GOTO 360
·340 LG=LN/LOG(10) : CH=INT(LG) :MN=LG-CH
·350 PRINT LEFT$(STR$(EXP(MN*LOG(10)))+"[
 10"0"]",12-LEN(STR$(CH)));"E"MID$(STR$(C
 H),2)
·360 END
·390 REM------STIRLING'S FORMULA---------
·400 INPUT "SPECIFY N LESS THAN 34";N
·410 NF=SQR(2*[PI]*N)*(N/EXP(1))[UPARROW]
 N
·420 PRINT N "! >" NF
·430 PRINT N "! <" NF*(1+1/(12*N-1))
·440 END
```

The first solution in lines 100 through 140 is from Matt Shapiro (Fort Lee, NJ). It is the only exact solution given here. Wait long enough and all 2568 digits of 1000! will eventually be printed. Matt mentioned that the program can calculate up to 4640! using the F array of 3000 elements.

The next solution from Rob Schultz (Fremont, CA) in lines 200 through 230 is not exact. It keeps track of the mantissa (M) and the exponent (E) of the answer separately. After each multiplication, factors of ten are removed from the product in line 220 and added to the exponent. That way the product stays small and exact up to nine digits. This program is faster than the exact one, but it still takes a while since N multiplications must be performed. Type RUN 200 to use this program.

The third program is from Charles Kluepfel (Bloomfield, NJ). It is less accurate than the previous two, but it is much faster. It uses a series approximation for the factorial function. Use this program to get values quickly even beyond 90,000! (That's a big number by the way.) Type RUN 300 for this program.

The fourth program has the advantage of being very short and fast, but it handles the smallest range of integers (N must be less than 34). This program uses Stirling's formula which is primarily used for approximating large factorials. Unfortunately in our computer, large factorials cause an overflow error. If you need a short function and an approximate value for small factorials, the formulas in lines 420 and 430 give lower and upper limits on the result. Type RUN 400 and enter a number less than 34 for this program.

Thanks also to Mario Segal (Mexico City, Mexico), Carl Stolberg (Traverse City, MI), Wm. G. James (Dunchurch, ONT), Clifford Dedmore (North Bend, OR), and Jack Baldrige (Boulder, CO). Jack sent COMAL and BASIC solutions with some timing analysis. His times to calculate 100! for BASIC, COMAL 0.14, COMAL 2.0, and compiled BASIC using the same algorithm were 78 seconds, 63 seconds, 35 seconds, and 24 seconds respectively. Jack said he wrote the program originally in COMAL 2.0 because of its structured logic and ease of modification.

There were at least two general approaches to *Problem #36-2: Animated Expansion*. The problem was to show an input word being expanded on the screen by inserting a specified number of spaces, one by one, between its letters. The one-liner below from Clifford Dedmore (North Bend, OR) performs the task by using the insert character CHR$(148).

```
·1 REM ===================================
·2 REM    COMMODARES PROBLEM #36-2 :
·3 REM    ANIMATED EXPANSION
·4 REM    SOLUTION BY
·5 REM    CLIFFORD DEDMORE
·6 REM ===================================
·10 INPUTW$,N:PRINT"[CLEAR]"W$"[HOME][RIG
HT]";:FORT=1TOLEN(W$):FORK=1TON:PRINTCHR
$(148)" ";:NEXT:PRINT"[RIGHT]";:NEXT
```

Specify the string and the number of spaces to be put between each letter, then watch it fly.

Another version of the program from Andre Lessard (Shawinigan-sud, Quebec) is listed below.

```
·1 REM ====================================
·2 REM    COMMODARES PROBLEM #36-2 :
·3 REM    ANIMATED EXPANSION
·4 REM    SOLUTION BY
·5 REM    ANDRE LESSARD
·6 REM ====================================
·10 INPUT"[CLEAR]ENTER A WORD";A$:INPUT"E
NTER A NUMBER";A:PRINT"[HOME][3"[DOWN]"]
"A$
·20 CR$=CHR$(148):B=1:C=LEN(A$)-1:X=1:Y=C
:Z=1:DEF FNB(A)=B+A+1 : GOSUB 40
·30 CR$=CHR$(20):B=C+2+C*A:X=C:Y=0:Z=-1:D
EF FNB(A)=B-A-1 : GOSUB 40 : GOTO 20
·40 FOR J=X TO Y STEP Z : FOR K=1 TO A :
PRINT"[HOME][3"[DOWN]"]"TAB(B)CR$ : NEXT
·50 B=FNB(A) : NEXT : RETURN
```

Andre's program sets up variables to expand the string in line 20 and variables to contract the string in line 30. The subroutine at line 40 performs both operations. This program also uses the "insert" character CHR$(148) to add spaces to the screen and the "delete" character CHR$(20) to delete them.

A different approach is shown in this program by Bing Perry (Monterey, CA).

```
·1 REM ====================================
·2 REM    COMMODARES PROBLEM #36-2 :
·3 REM    ANIMATED EXPANSION
·4 REM    SOLUTION BY
·5 REM    BING PERRY
·6 REM ====================================
·10 INPUT"[CLEAR]ENTER NUMBER OF SPACES";
S
·20 INPUT"ENTER WORD";A$ : L=LEN(A$)
·30 PRINT "[CLEAR]"A$ : GOSUB 100 : FOR K
=1 TO L-1
·40 FOR J=1 TO S : A$=LEFT$(A$,(K-1)*(S+1
)+J)+"."+RIGHT$(A$,L-K):PRINT"[HOME]"+A$
·50 GOSUB 100 : NEXT : NEXT
·60 FOR K=L-1 TO 1 STEP -1
·70 FOR J=S TO 1 STEP -1 : A$=LEFT$(A$,(K
-1)*(S+1)+J)+RIGHT$(A$,L-K)
·80 PRINT"[HOME]"+A$+" ":GOSUB 100 :NEXT
:NEXT
·90 END
·100 FOR T=1 TO 20 : NEXT : RETURN
```

Bing's program creates a different string value for each stage of the expansion or compression. The advantage of building strings rather than merely using the screen insert character is that characters other than spaces may now be used for the expansion. Change the "." character in line 40 to any other character and see the results. You can adjust the speed of operation by changing the 20 in line 100 to any other value.

Jim Speers (Niles, MI) sent some interesting applications along with his solution listed below.

```
·1 REM ====================================
·2 REM    COMMODARES PROBLEM #36-2 :
·3 REM    ANIMATED EXPANSION
·4 REM    SOLUTION BY
·5 REM    JIM SPEERS
·6 REM ====================================
·100 FOR I=1 TO 40:B$=B$+" ":NEXT I
·110 INPUT"[CLEAR][DOWN]ENTER TEXT";W$
·120 INPUT"[DOWN]# OF SPACES";N:PRINT"[CL
EAR]"
·130 REM N=3 : W$=" QB JO LD TURFUVTAO HI
OOMEHZG ECWXPREYS  KN S"
·140 REM N=1 : W$="[6" "][RVSON]M[RVSON]E
[RVSON]N[RVSON]U[RVSON]"
·150 REM N=7 : W$="1 4 52+5=73 6 9"
·160 REM N=7 : W$=" M[4" "]O H  NDO  TAU
 HYR  [3"[c T]"]"
·170 K=1 : GOSUB 210
·180 FOR I=1 TO N:GOSUB 220 : PRINT P1$LE
FT$(B$,I)P2$:FORJ=1TO1:NEXTJ:NEXTI
·190 W$=P1$+LEFT$(B$,N)+P2$:K=LEN(P1$)+N+
1:GOSUB210:IF P2$="" THEN END
·200 GOTO 180
·210 P1$=LEFT$(W$,K):P2$=MID$(W$,K+1,255)
:RETURN
·220 IF DS$="" THEN POKE 780,0:POKE 781,1
:POKE 782,0 : SYS 65520 : RETURN
·230 SYS 65520,0,1,0 : RETURN
```

Remove the REM from the beginning of line 130 and just press RETURN in response to the two prompts. To see the other examples, remove the REMs from lines 140 through 160 one at a time and run each one. Line 220 is for the C-64 to call the PLOT Kernal routine so the cursor always starts at row 1 column 0 (the second and third POKEs are the row and column numbers). Line 230 does the same thing for the C-128. Recall that DS$ has special meaning for the C-128 (disk status), but it is just a null string for the C-64. You can adjust the speed

with the values in the J loop in line 180. Jim's examples work with a 40-column screen.

Solutions to this problem and others came from these readers: Curt D'Onofrio (Shelton, CT), Sol Katz (Lakewood, CO), Sixto Santos, Jerry Torres (Daggett, CA), Ivan Rudyk (Burlington, ONT), Brian Carr (Hermitage, TN), Stephane Edwardson (La Tuque, QUE), Karen Middaugh (San Diego, CA), Steve Schowiak (Giessen, W. Germany), David Embry (San Diego, CA), and Ed Hoofnagle (Cove, OR).

Problem #36-3: Life Times suggested by Bill Okerblom (Providence, RI) convinced quite a few readers that you don't have to be a super-powered programming expert to solve *Commodares* (although it may help in some cases). The user enters his age. The program then displays the dates of the previous 100 lifetimes of the user. The idea here is to show historical times from a different perspective.

The following solution from Rick Needham (Croton-on-Hudson, NY) easily meets the requirements of the problem.

```
•1 REM ===================================
•2 REM    COMMODARES PROBLEM #36-3 :
•3 REM    LIFE TIMES
•4 REM    SOLUTION BY
•5 REM    RICK NEEDHAM
•6 REM ===================================
•10 INPUT "AGE";A: FOR X=1 TO 100: Y=1987
 -A*X : IF Y<=0 THEN Y=Y*-1+1 : A$="BC"
•20 PRINT X,Y;A$: NEXT : END
```

Enter your age at the prompt. The program then shows the year one lifetime ago. It should be your birth year (or one year later if you haven't had a birthday yet this year). It also shows the other previous years. Rick's program handles the B.C. years properly (there was no 0 B.C.) with the IF-THEN statement.

Lon Olson (Mesa, AZ) used some fancy looping and logic on the C-128 and fit the program into one line as follows:

```
•1 REM ===================================
•2 REM    COMMODARES PROBLEM #36-3 :
•3 REM    LIFE TIMES
•4 REM    SOLUTION BY
•5 REM    LON OLSON
•6 REM ===================================
•10 INPUT"[CLEAR][DOWN][DOWN]AGE=";A:Y=19
 87:DO:I=I+1:Y=Y-A:IFI>100THENSTOP:ELSEIF
 Y<=0THENEXIT:ELSEPRINTI") "Y:LOOP:Y=1+AB
 S(Y):DOUNTILI>100:PRINTI") "Y"BC":Y=Y+A:
 I=I+1:LOOP
```

By cleverly using a logical variable as an array index, Clifford Dedmore (North Bend, OR) fit his solution into one line also. Enter the current year and your age into this program.

```
•1 REM ===================================
•2 REM    COMMODARES PROBLEM #36-3 :
•3 REM    LIFE TIMES
•4 REM    SOLUTION BY
•5 REM    CLIFFORD DEDMORE
•6 REM ===================================
•10 T$(1)="BC":INPUTY,A:FORK=1TO100:Y=Y-A
 :PRINTK,ABS(Y)-(Y<1);T$(-(Y<1)):NEXT
```

The expression (Y<1) has a value of −1 (true) if Y is less than 1 and a value of 0 (false) otherwise. For A.D. years, (Y<1) is zero. T$(0) is the null string. For B.C. years, (Y<1) is −1. Consequently the B.C. years are properly corrected, and T$(1) which is "BC" is printed.

Congratulations to these readers for solutions to this problem: Carlos Centeno (Lares, PR), L. W. Brenneman (Erie, PA), Stephen Rasmussen (Nacogdoches, TX), Ben Medich (Weehawken, NJ), Jorge Milke (Mexico City, Mexico), Jonathan Davis—let's hear it for Kid Power! (Henderson, KY), Karen Middaugh (San Diego, CA), James Bauer (Portland, OR), Mario Segal (Mexico City, Mexico), Ronald Weiner (Levittown, PA), Jim Speers (Niles, MI), and Paul Sobolik (Pittsburgh, PA).

Problem #36-4: Crossed Ladders brought out the best of the geometricians, trigonometricians, and numerical analysts. There are two ladders leaning against buildings on opposite sides of a street, each ladder going from the base of one building to the wall of the other. The ladders are 20 and 30 feet long and their point of intersection is 6 feet above the street. The problem is to find out the width of the street.

Several readers mentioned that the problem can be solved algebraically, but they wee equally quick to add that solving it is a very hard task. The procedure is then to set up the equations, and let the computer solve them.

Let the width of the street be X and the heights of the two ladders against the buildings be HS and HL for the short and long ladders, respectively. HS and HL can be determined from the Pythagorean Theorem to be:

```
HS = SQR (20^2 - X^2)

HL = SQR (30^2 - X^2)
```

It can be shown from properties of similar triangles or with trigonometric relations (and some algebraic manipulations) that the height of the intersection of the ladders above the street HX is:

```
       ( HS * HL)
HX = ------------
       ( HS + HL)
```

Now you can write a program which repeatedly increments X. For each value of X, the program evaluates HS, HL, and HX. The value of X for which HX has a value of 6 is the answer. The size of the X increments determines the accuracy of your result.

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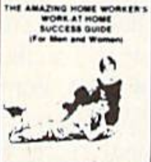
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A more sophisticated program starts with large increments of X until the approximate range of the answer is found. Then the increment is reduced and a smaller range of X values is searched. This process is repeated until the desired accuracy is obtained.

The most elegant approach is to use one of the standard methods of numerical analysis for finding roots of equations. The program below from Andy Young (Ottawa, ONT) uses a method he calls fixed-point iteration.

```
•1 REM ====================================
•2 REM     COMMODARES PROBLEM #36-4 :
•3 REM     CROSSED LADDERS
•4 REM     SOLUTION BY
•5 REM     ANDY YOUNG
•6 REM ====================================
•10 LL=30 : LS=20 : HT=6 : K=2
•20 X0=1 :REM INITIAL VALUE
•30 PRINT "X0, GX, HX"
•100 FOR II=0 TO -1 STEP -1
•110 HS=SQR(LS*LS-X0*X0)
•120 HL=SQR(LL*LL-X0*X0)
•130 HX=HS*HL/(HS+HL)
•140 FX=HT-HX
•150 GX=X0-FX/K
•160 PRINT X0,GX,HX
•170 X0=GX
•180 II=(ABS(FX/GX) < 1E-8)
•190 NEXT II
```

The goal is to find a value of X to satisfy the equation HX=6. This function of X is written as F(X)=6−HX where now the goal is to solve for F(X)=0. (Yes, this is confusing at first. If F(X)=0, then 6−HX=0, and therefore, HX=6 as desired.)

The procedure is to restate the function of X in the form X=G(X). The simplest form for G(X) is G(X) = X − F(X)/K where K is any constant. The iteration involves evaluating G(X), assigning this value to X, and then evaluating G(X) again. The iteration is repeated until X stops changing. At this point, X and G(X) are the same, and F(X) is zero as desired.

Andy uses the FOR/NEXT loop at line 100 as a DO WHILE loop. On the C-128 you could replace lines 100 and 190 as follows:

```
•100 DO WHILE II=0
•190 LOOP
```

The values of HS, HL, and HX are calculated. Then FX and GX (representing F(X) and G(X)) are evaluated. Line 170 assigns this new value of GX to X0. Line 180 determines the relative closeness of FX to 0. If FX is less than 1E−8 times GX then II is set to −1, and the FOR-NEXT loop is completed. Otherwise II has the value 0, and the loop is repeated.

This general procedure can be used to find the zeroes of any function. Simply replace the definition of FX in line 140. For other equations you may have to pick a different value of K or a different initial value of X0 to get a proper answer. Changing K to −2 in this program for example causes convergence to a negative value of X0, a valid solution to the equation but not to the problem.

Andy said that there are other forms of G(X) which converge ("home in") on the correct value of X faster than this fixed-point form, but this is the easiest form to determine and to program. The reader is referred to books on numerical analysis for further discussions. (Newton's method and secant method are two related topics. Newton's method uses the first derivative of F(X) in place of K, for example.)

By the way, the answer to the problem is roughly 18.3 feet. Thanks to Troy Shoap and David Brouse (Shippensburg, PA) for their explanations and graphical analysis of the problem. They plotted "distance between buildings vs. height of intersection" for the two ladders. You might enjoy graphing this problem as well.

Congratulations also to Sarah Jane Butler (Decatur, IN), W.J. McMahon (Agawam, MA), Justin Smalley (Boulder, CO), Jim Frost (La Mesa, CA), Tom Zerrusen (Teutopolis, IL), Rick Schwamle (Overland, MO), Matt Shapiro (Fort Lee, NJ), and Jim Speers (Niles, MI) for work on this problem. Thanks for all the diagrams and detailed explanations. Keep those solutions and problems coming. □

PROGRAM LISTINGS

Attention new *Ahoy!* readers! You must read the following information very carefully prior to typing in programs listed in *Ahoy!* Certain Commodore characters, commands, and strings of characters and commands will appear in a special format. Follow the instructions and listing guide on this page.

On the following pages you'll find several programs that you can enter on your Commodore computer. But before doing so, read this entire page carefully.

To insure clear reproductions, *Ahoy!*'s program listings are generated on a daisy wheel printer, incapable of printing the commands and graphic characters used in Commodore programs. These are therefore represented by various codes enclosed in brackets [ ]. For example: the SHIFT CLR/HOME command is represented onscreen by a heart. The code we use in our listings is [CLEAR]. The chart below lists all such codes which you'll encounter in our listings, except for one other special case.

The other special case is the COMMODORE and SHIFT characters. On the front of most keys are two symbols. The symbol on the left is obtained by pressing that key while holding down the COMMODORE key; the symbol on the right, by pressing that key while holding down the SHIFT key. COMMODORE and SHIFT characters are represented in our listings by a lower-case "s" or "c" followed by the symbol of the key you must hit. COMMODORE J, for example, is represented by [c J], and SHIFT J by [s J].

Additionally, any character that occurs more than two times in a row will be displayed by a coded listing. For example, [3 "[LEFT]"] would be 3 CuRSoR left commands in a row, [5 "[s EP]"] would be 5 SHIFTed English Pounds, and so on. Multiple blank spaces will be noted in similar fashion: e.g., 22 spaces as [22 " "].

Sometimes you'll find a program line that's too long for the computer to accept (C-64 lines are a maximum of 80 characters, or 2 screen lines long; VIC 20 lines, a maximum of 88 characters, or 4 screen lines). To enter these lines, refer to the *BASIC Command Abbreviations Appendix* in your User Manual.

On the next page you'll find our *Bug Repellent* programs for the C-128 and C-64. The version appropriate for your machine will help you proofread our programs after you type them. (Please note: the *Bug Repellent* line codes that follow each program line, in the whited-out area, should *not* be typed in. See the instructions preceding each program.)

Also on the following page you will find *Flankspeed*, our ML entry program, and instructions on its use. □

Call *Ahoy!* at 212-239-0855 with any problems.

When You See	It Means	You Type	You Will See
[CLEAR]	Screen Clear	SHIFT CLR/HOME	
[HOME]	Home	CLR/HOME	
[UP]	Cursor Up	SHIFT ↑CRSR↓	
[DOWN]	Cursor Down	↑CRSR↓	
[LEFT]	Cursor Left	SHIFT ←CRSR→	
[RIGHT]	Cursor Right	←CRSR→	
[SS]	Shifted Space	SHIFT Space	
[INSERT]	Insert	SHIFT INST/DEL	
[DEL]	Delete	INST/DEL	
[RVSON]	Reverse On	CNTRL 9	
[RVSOFF]	Reverse Off	CNTRL 0	
[UPARROW]	Up Arrow	↑	
[BACKARROW]	Back Arrow	←	
[PI]	PI	π	
[EP]	English Pound	£	

When You See	It Means	You Type	You Will See
[BLACK]	Black	CNTRL 1	
[WHITE]	White	CNTRL 2	
[RED]	Red	CNTRL 3	
[CYAN]	Cyan	CNTRL 4	
[PURPLE]	Purple	CNTRL 5	
[GREEN]	Green	CNTRL 6	
[BLUE]	Blue	CNTRL 7	
[YELLOW]	Yellow	CNTRL 8	
[F1]	Function 1	F1	
[F2]	Function 2	SHIFT F1	
[F3]	Function 3	F3	
[F4]	Function 4	SHIFT F3	
[F5]	Function 5	F5	
[F6]	Function 6	SHIFT F5	
[F7]	Function 7	F7	
[F8]	Function 8	SHIFT F7	

BUG REPELLENT By MICHAEL KLEINERT and DAVID BARRON

Bug Repellent is a checksum program used for proofreading BASIC listings typed in from *Ahoy!* magazine. For each program line you enter, *Bug Repellent* will produce a two-letter code that should match the code listed beside that line in the magazine.

Type in, save, and run the *Bug Repellent.* (If you have a C-64, type in the C-64 version. If you have a C-128, you will need to type in the C-64 version for use with C-64 programs, and the C-128 version for use with C-128 programs.) If you have typed in *Bug Repellent* properly, you will get the message BUG REPELLENT INSTALLED; otherwise you will get an error message. If you get an error message, double check the *Bug Repellent* program for typing mistakes. Type NEW and hit RETURN. Then type in and save, or load, the *Ahoy!* program you wish to check. Type in SYS 49152 for the C-64 version or SYS 3072 for the C-128 version and hit RETURN (this will begin execution of *Bug Repellent*). You will see the prompt SCREEN OR PRINTER ? Hit S if you want the codes listed on the screen, or P if you want them listed on the printer. To pause the listing depress and hold the SHIFT key.

Compare the codes your machine generates to those listed to the right of the corresponding program lines. If you spot a difference, that line contains an error. Write down the numbers of the lines where the contradictions occur. LIST each line, locate the errors, and correct them.

COMMODORE 64 VERSION

```
•100 FOR X = 49152 TO 49488:READY:S=S+Y              AB
•110 IF Y<0 OR Y>255 THEN 130                        EA
•120 POKE X,Y:NEXT:GOTO140                           ID
•130 PRINT"[CLEAR][DOWN]**ERROR**":PRINT"[DOWN
]PLEASE CHECK LINE"PEEK(64)*256+PEEK(63):END         ID
•140 IF S<>44677 THEN PRINT"[CLEAR][DOWN]**ERR
OR**":PRINT"[DOWN]PLEASE CHECK DATA LINES 170
-500":END                                            HJ
•150 PRINT"[CLEAR]":POKE53280,0:POKE53281,6:PO
KE646,1                                              NP
•160 PRINT"[RVSON][6" "]C-64 BUG REPELLENT INS
TALLED[6" "]"                                        LF
•170 DATA32,161,192,165,43,133,251,165,44,133        DL
•180 DATA252,160,0,132,254,32,37,193,234,177         DB
•190 DATA251,208,3,76,138,192,230,251,208,2          OF
•200 DATA230,252,76,43,192,76,73,78,69,32            KN
•210 DATA35,32,0,169,35,160,192,32,30,171            CA
•220 DATA160,0,177,251,170,230,251,208,2,230         CE
•230 DATA252,177,251,32,205,189,169,58,32,210        JE
•240 DATA255,169,0,133,253,230,254,32,37,193         CL
•250 DATA234,165,253,160,0,76,13,193,133,253         NB
•260 DATA177,251,208,237,165,253,41,240,74,74        MB
•270 DATA74,74,24,105,65,32,210,255,165,253          EP
•280 DATA 41,15,24,105,65,32,210,255,169,13          GH
•290 DATA32,220,192,230,63,208,2,230,64,230          AN
•300 DATA251,208,2,230,252,76,11,192,169,153         NG
•310 DATA160,192,32,30,171,166,63,165,64,76          BF
•320 DATA231,192,96,76,73,78,69,83,58,32             EP
•330 DATA0,169,247,160,192,32,30,171,169,3           PJ
•340 DATA133,254,32,228,255,201,83,240,6,201         FK
•350 DATA80,208,245,230,254,32,210,255,169,4         FL
•360 DATA166,254,160,255,32,186,255,169,0,133        CL
•370 DATA63,133,64,133,2,32,189,255,32,192           GC
•380 DATA255,166,254,32,201,255,76,73,193,96         NN
•390 DATA32,210,255,173,141,2,41,1,208,249           NH
•400 DATA96,32,205,189,169,13,32,210,255,32          IM
•410 DATA204,255,169,4,76,195,255,147,83,67          KC
•420 DATA82,69,69,78,32,79,82,32,80,82               DC
•430 DATA 73,78,84,69,82,32,63,32,0,76               ML
•440 DATA44,193,234,177,251,201,32,240,6,138         GN
•450 DATA113,251,69,254,170,138,76,88,192,0          JK
•460 DATA0,0,0,230,251,208,2,230,252,96              NA
•470 DATA170,177,251,201,34,208,6,165,2,73           DM
•480 DATA255,133,2,165,2,208,218,177,251,201         JA
•490 DATA32,208,212,198,254,76,29,193,0,169          FM
•500 DATA13,76,210,255,0,0,0                         PA
```

COMMODORE 128 VERSION

```
•100 FAST:FOR X = 3072 TO 3520:READ Y:POKE X,Y
:S=S+Y:TRAP110:NEXT:SLOW                             IH
•110 SLOW:IF S<>49057 THEN PRINT"[CLEAR][DOWN]
**ERROR**":PRINT"[DOWN]PLEASE CHECK DATA LINE
S 140-390":END                                       JA
•120 PRINT"[CLEAR][DOWN]  C-128 BUG REPELLENT
INSTALLED"                                           II
•130 PRINT"[4" "]TYPE SYS 3072 TO ACTIVATE"          IN
•140 DATA 32,161,12,165,45,133,251,165,46,133,
252,160,0,132,254,32,37                              OF
•150 DATA 13,234,177,251,208,3,76,138,12,230,2
51,208,2,230,252,76,43                               NC
•160 DATA 12,76,73,78,69,32,35,32,0,169,35,160
,12,32,80,13,160,0,177                               OL
•170 DATA 251,170,230,251,208,2,230,252,177,25
1,32,89,13,169,58,32,98                              EF
•180 DATA 13,169,0,133,253,230,254,32,37,13,23
4,165,253,160,0,76,13                                JO
•190 DATA 13,133,253,177,251,208,237,165,253,4
1,240,74,74,74,74,24                                 LC
•200 DATA 105,65,32,98,13,165,253,41,15,24,105
,65,32,98,13,169,13,32                               DE
•210 DATA 220,12,230,65,208,2,230,66,230,251,2
08,2,230,252,76,11,12                                GM
•220 DATA 169,153,160,12,32,80,13,166,65,165,6
6,76,231,12,96,76,73,78                              CP
•230 DATA 69,83,58,32,0,169,247,160,12,32,80,1
3,169,3,133,254,32,107                               HC
•240 DATA 13,201,83,240,6,201,80,208,245,230,2
54,32,98,13,169,4,166                                GK
•250 DATA 254,160,255,32,116,13,169,0,133,65,1
33,66,133,250,32,125,13                              LB
•260 DATA 32,134,13,166,254,32,143,13,76,73,13
,96,32,98,13,165,211                                 JF
•270 DATA 234,41,1,208,249,96,32,89,13,169,13,
32,98,13,32,152,13,169,4                             GD
•280 DATA 76,161,13,147,83,67,82,69,69,78,32,7
9,82,32,80,82,73,78,84,69                            PL
•290 DATA 82,32,63,32,0,76,44,13,234,177,251,2
01,32,240,6,138,113,251,69                           OK
•300 DATA 254,170,138,76,88,12,0,0,0,0,230,251
,208,2,230,252,96,170,177                            FJ
•310 DATA 251,201,34,208,6,165,250,73,255,133,
250,165,250,208,218,177                              GA
•320 DATA 251,201,32,208,212,198,254,76,29,13,
0,169,13,76,98,13,0,0,32                             FI
•330 DATA 170,13,32,226,85,76,180,13,32,170,13
,32,50,142,76,180,13,32                              OF
•340 DATA 170,13,32,210,255,76,180,13,32,170,1
3,32,228,255,76,180,13,32                            AK
•350 DATA 170,13,32,186,255,76,180,13,32,170,1
3,32,189,255                                         BP
•360 DATA 76,180,13,32,170,13,32,192,255,76,18
0,13,32,170,13                                       FP
•370 DATA 32,201,255,76,180,13,32,170,13,32,20
4,255,76,180,13,32,170                               ID
•380 DATA 13,32,195,255,76,180,13,133,67,169,0
,141,0,255,165,67,96                                 BJ
•390 DATA 133,67,169,0,141,1,255,165,67,96,0,0
,0                                                   IF
```

FLANKSPEED FOR THE C-64 By GORDON F. WHEAT

Flankspeed will allow you to enter machine language *Ahoy!* programs without any mistakes. Once you have typed the program in, save it for future use. While entering an ML program with *Flankspeed* there is no need to enter spaces or hit the carriage return. This is all done automatically. If you make an error in a line a bell will ring and you will be asked to enter it again. To LOAD in a program Saved with *Flankspeed* use LOAD "name",1,1 for tape, or LOAD "name",8,1 for disk. The function keys may be used after the starting and ending addresses have been entered.

f1 – SAVEs what you have entered so far.
f3 – LOADs in a program worked on previously.
f5 – To continue on a line you stopped on after LOADing in the previous saved work.
f7 – Scans through the program to locate a particular line, or to find out where you stopped the last time you entered the program.
f7 temporarily freezes the output as well.

```
·100 POKE53280,12:POKE53281,11                                LL
·105 PRINT"[CLEAR][c 8][RVSON][15" "]FLANKSPEED[15" "]";      ED
·110 PRINT"[RVSON][5" "]MISTAKEPROOF ML ENTRY PROGRAM[6" "
]"                                                             MC
·115 PRINT"[RVSON][9" "]CREATED BY G. F. WHEAT[9" "]"          DM
·120 PRINT"[RVSON][3" "]COPR. 1984, ION INTERNATIONAL INC.
[3" "]"                                                        DH
·125 FORA=54272TO54296:POKEA,0:NEXT                           IM
·130 POKE54272,4:POKE54273,48:POKE54277,0:POKE54278,249:PO
KE54296,15                                                     NH
·135 FORA=680TO699:READB:POKEA,B:NEXT                         KO
·140 DATA169,251,166,253,164,254,32,216,255,96                HJ
·145 DATA169,0,166,251,164,252,32,213,255,96                  JB
·150 B$="STARTING ADDRESS IN HEX":GOSUB430:AD=B:SR=B          KA
·155 GOSUB480:IFB=0THEN150                                    GN
·160 POKE251,T(4)+T(3)*16:POKE252,T(2)+T(1)*16                KE
·165 B$="ENDING ADDRESS IN HEX":GOSUB430:EN=B                 LO
·170 GOSUB470:IFB=0THEN150                                    EE
·175 POKE254,T(2)+T(1)*16:B=T(4)+1+T(3)*16                    MN
·180 IFB>255THENB=B-255:POKE254,PEEK(254)+1                   GE
·185 POKE253,B:PRINT                                          HN
·190 REM  GET HEX LINE                                        IL
·195 GOSUB495:PRINT": [c P][LEFT]";:FORA=0TO8                 NH
·200 FORB=0TO1:GOTO250                                        MP
·205 NEXTB                                                    ME
·210 A%(A)=T(1)+T(0)*16:IFAD+A-1=ENTHEN340                    LE
·215 PRINT" [c P][LEFT]";                                     IK
·220 NEXTA:T=AD-(INT(AD/256)*256):PRINT" "                    PD
·225 FORA=0TO7:T=T+A%(A):IFT>255THENT=T-255                   LK
·230 NEXT                                                     IA
·235 IFA%(8)<>TTHENGOSUB375:GOTO195                           LE
·240 FORA=0TO7:POKEAD+A,A%(A):NEXT:AD=AD+8:GOTO195            BI
·245 REM    GET HEX INPUT                                     AB
·250 GETA$:IFA$=""THEN250                                     HK
·255 IFA$=CHR$(20)THEN305                                     HF
·260 IFA$=CHR$(133)THEN535                                    KH
·265 IFA$=CHR$(134)THEN560                                    JM
·270 IFA$=CHR$(135)THENPRINT" ":GOTO620                       EG
·275 IFA$=CHR$(136)THENPRINT" ":GOTO635                       AB
·280 IFA$>"@"ANDA$<"G"THENT(B)=ASC(A$)-55:GOTO295             DL
·285 IFA$>"/"ANDA$<":"THENT(B)=ASC(A$)-48:GOTO295             MD
·290 GOSUB415:GOTO250                                         JJ
·295 PRINTA$"[c P][LEFT]";                                    OA
·300 GOTO205                                                  CF
·305 IFA>0THEN320                                             PG
·310 A=-1:IFB=1THEN330                                        OI
·315 GOTO220                                                  BM
·320 IFB=0THENPRINTCHR$(20);CHR$(20);:A=A-1                   HG
·325 A=A-1                                                    BE
·330 PRINTCHR$(20);:GOTO220                                   LK
·335 REM LAST LINE                                            AD
·340 PRINT" ":T=AD-(INT(AD/256)*256)                          GJ
·345 FORB=0TOA-1:T=T+A%(B):IFT>255THENT=T-255                 PL
·350 NEXT                                                     IA
·355 IFA%(A)<>TTHENGOSUB375:GOTO195                           NF
·360 FORB=0TOA-1:POKEAD+B,A%(B):NEXT                          HN
·365 PRINT:PRINT"YOU ARE FINISHED!":GOTO535                   JA
·370 REM BELL AND ERROR MESSAGES                              FL
·375 PRINT:PRINT"LINE ENTERED INCORRECTLY":PRINT:GOTO415      DA
·380 PRINT:PRINT"INPUT A 4 DIGIT HEX VALUE!":GOTO415          FF
·385 PRINT:PRINT"ENDING IS LESS THAN STARTING!":B=0:GOTO41
```

```
5                                                              HD
·390 PRINT:PRINT"ADDRESS NOT WITHIN SPECIFIED RANGE!":B=0:
GOTO415                                                        OK
·395 PRINT:PRINT"NOT ZERO PAGE OR ROM!":B=0:GOTO415           FN
·400 PRINT"?ERROR IN SAVE":GOTO415                            PP
·405 PRINT"?ERROR IN LOAD":GOTO415                            PO
·410 PRINT:PRINT:PRINT"END OF ML AREA":PRINT                  PG
·415 POKE54276,17:POKE54276,16:RETURN                         BH
·420 OPEN15,8,15:INPUT#15,A,A$:CLOSE15:PRINTA$:RETURN         IM
·425 REM GET FOUR DIGIT HEX                                   PC
·430 PRINT:PRINTB$;:INPUTT$                                   GM
·435 IFLEN(T$)<>4THENGOSUB380:GOTO430                         NP
·440 FORA=1TO4:A$=MID$(T$,A,1):GOSUB450:IFT(A)=16THENGOSUB
380:GOTO430                                                    FJ
·445 NEXT:B=(T(1)*4096)+(T(2)*256)+(T(3)*16)+T(4):RETURN      GF
·450 IFA$>"@"ANDA$<"G"THENT(A)=ASC(A$)-55:RETURN              EH
·455 IFA$>"/"ANDA$<":"THENT(A)=ASC(A$)-48:RETURN              KP
·460 T(A)=16:RETURN                                           NP
·465 REM ADRESS CHECK                                         LI
·470 IFAD>ENTHEN385                                           LB
·475 IFB<SRORB>ENTHEN390                                      KC
·480 IFB<256OR(B>40960ANDB<49152)ORB>53247THEN395             MG
·485 RETURN                                                   IM
·490 REM ADDRESS TO HEX                                       EB
·495 AC=AD:A=4096:GOSUB520                                    FD
·500 A=256:GOSUB520                                           PE
·505 A=16:GOSUB520                                            MI
·510 A=1:GOSUB520                                             IL
·515 RETURN                                                   IM
·520 T=INT(AC/A):IFT>9THENA$=CHR$(T+55):GOTO530               PE
·525 A$=CHR$(T+48)                                            JP
·530 PRINTA$;:AC=AC-A*T:RETURN                                AC
·535 A$="**SAVE**":GOSUB585                                   LH
·540 OPEN1,T,1,A$:SYS680:CLOSE1                               LH
·545 IFST=0THENEND                                            EO
·550 GOSUB400:IFT=8THENGOSUB420                               CM
·555 GOTO535                                                  CL
·560 A$="**LOAD**":GOSUB585                                   NE
·565 OPEN1,T,0,A$:SYS690:CLOSE1                               MF
·570 IFST=64THEN195                                           LC
·575 GOSUB405:IFT=8THENGOSUB420                               AN
·580 GOTO560                                                  CL
·585 PRINT" ":PRINTTAB(14)A$                                  FG
·590 PRINT:A$="":INPUT"FILENAME";A$                           OM
·595 IFA$=""THEN590                                           DD
·600 PRINT:PRINT"TAPE OR DISK?":PRINT                         DF
·605 GETB$:T=1:IFB$="D"THENT=8:A$="@0:"+A$:RETURN             IG
·610 IFB$<>"T"THEN605                                         BO
·615 RETURN                                                   IM
·620 B$="CONTINUE FROM ADDRESS":GOSUB430:AD=B                 OH
·625 GOSUB475:IFB=0THEN620                                    GH
·630 PRINT:GOTO195                                            PH
·635 B$="BEGIN SCAN AT ADDRESS":GOSUB430:AD=B                 FA
·640 GOSUB475:IFB=0THEN635                                    IB
·645 PRINT:GOTO670                                            PP
·650 FORB=0TO7:AC=PEEK(AD+B):GOSUB505:IFAD+B=ENTHENAD=SR:G
OSUB410:GOTO195                                                NK
·655 PRINT" ";:NEXTB                                          EC
·660 PRINT:AD=AD+8                                            GN
·665 GETB$:IFB$=CHR$(136)THEN195                              LI
·670 GOSUB495:PRINT": ";:GOTO650                              IB
```

INFOFLOW
FROM PAGE 37

```
·10 TRAP1690                                    KJ
·20 REM ****************************            KF
·30 REM *          INFOFLOW             *       EI
·40 REM *   BY CLEVE BLAKEMORE          *       HG
·50 REM *  DATABASE FOR THE C128        *       AO
·60 REM ****************************            KF
·70 FAST:COLOR4,13:FORX=3584TO4096:READA:
POKEX,A:NEXT                                    HP
·80 COLOR0,1:COLOR4,12:COLOR5,7:COLOR1,15
:PRINTCHR$(14)CHR$(11):GRAPHIC 2,1,25           PH
·90 RESTORE2630:FORI=.TO63:READA:A$=A$+CH
R$(A):NEXTI:I=FRE(.):SPRSAV1,B$:SPRSAVA$
,1:SPRSAV1,A$:SPRSAVB$,1                        JA
·100 SPRITE1,1,16,,,,.:MOVSPR1,160,150:GS
HAPEA$,270,100                                  PE
·110 RESTORE2720:FORX=2TO8:SPRITEX,1,7,,,
,.:NEXT:FORX=2TO8:READA,I:MOVSPRX,A,I:BO
X1,A-29,I-55,A+5,I-25:NEXT:DRAW1,0,78TO3
20,78                                           PE
·120 CHAR1,0,0,CHR$(14)+"  *[12" "][s I]N
FO[s F]LOW[14" "]*  ",1                         BB
·130 CHAR1,2,6,CHR$(14)+"[s S]AVE[6" "][s
 N]EW[6" "][s D]ELETE[4" "][s V]IEW-[s A
]DD"                                            EO
·140 CHAR1,2,7,CHR$(14)+"[s L]OAD[6" "][s
 F]ILE[5" "][s R]ECORD[5" "][s R]ECORD"         DO
·150 CHAR1,2,16,CHR$(14)+"[s S]ORT[4" "][
s S]EARCH[5" "][s H]ARDCOPY[3" "][s C]UR
RENT":CHAR1,32,17,CHR$(14)+"[s R]ECORD#"        LL
·160 COLOR1,12:CHAR1,0,20,CHR$(14)+"  * [
s B]Y [s C]LEVELAND [s M]. [s B]LAKEMORE
[11" "]",1                                      GK
·170 CHAR1,0,22,CHR$(14)+"[3" "][s S][s P
][s A][s C][s E][SS][s I][s N][SS][s M][
s E][s M][s O][s R][s Y][SS][s F][s O][s
 R][7" "][s R]ECORDS !  ":COLOR1,7:CHAR1
,16,24,"  QUIT  ",1:SLOW                        MD
·180 TRAP1690:COLLISION1,1650:V=53248:M$=
"[3"[DOWN]"][c 5] [s N]O [s F]ILE IN [s
M]EMORY!":MC$="[3"[DOWN]"][c 5] [s F]ILE
 [s C]URRENTLY IN [s M]EMORY!":CHAR1,23,
22,"[5" "]":DIMBO(7)                            PL
·190 FORX=0TO7:BO(X)=2[UPARROW]X:NEXT:TL=
.:EF=.:CR=.:X=.:Y=.:A=.:B=.:G=.:C=.:O=.:
I=.:J=.:N=.:RL%=.:FT$="":CR$=CHR$(13):A$
="":B$="":M=.:K=.:L=.:F=.                       HK
·200 SOUND1,15000,20,0,5000,5000,1:IFJOY(
2)THEN200                                       OB
·210 G=BUMP(1):DO:DO:A=JOY(2):IFA=.THENLO
OP:ELSEB=AAND15:I=(B-1)*45:MOVSPR1,-6*(B
<>0);I:A=JOY(2):LOOPWHILEA=B:IF(AAND128)
THENEXIT:ELSELOOP                               BF
·220 SOUND1,15000,20,0,5000,5000,1:X=RSPP
OS(1,0):Y=RSPPOS(1,1):IFX>270ANDX<320AND
Y>130ANDY<200THENGOSUB1370:C=.:O=.:G=BUM
P(1):GOTO200                                    AD
·230 IFY>234THENBEGIN:SOUND1,25000,50,0,2
000,2000,0:COLOR1,15:CHAR1,16,24,"  QUIT
? ",1:DO:LOOPUNTILJOY(2)=.                      CI
·240 DO:IFJOY(2)>127THENGRAPHIC0:POKEV+21
,.:COLOR0,12:COLOR5,14:COLOR4,14:PRINTCH
R$(12)CHR$(142)CHR$(19)CHR$(19)CHR$(147)
:END                                            JB
·250 LOOPUNTILJOY(2)ANDJOY(2)<128:COLOR1,
7:CHAR1,16,24,"  QUIT  ",1:O=.:G=.:C=.:G
OTO210                                          DO
·260 BEND                                       BG
·270 ONCGOSUB290,570,680,910,1040,1180,12
30                                              BB
·280 GOTO200                                    BO
·290 REM SAVE/LOAD FILE                         EB
·300 GOSUB1520:GRAPHIC0:PRINT"[CLEAR][BLU
E]":WINDOW1,2,39,24,1:DIRECTORY"[s I][s
F]*":WINDOW1,1,39,1,1:PRINT"[RVSON][c 8]
[s S][RVSOFF]AVE OR [RVSON][s L][RVSOFF]
OAD?[BLUE]";                                    PF
·310 POKE208,.:DO:GETKEYA$:LOOPUNTILA$="S
"ORA$="L"                                       LK
·320 IFA$="L"THEN420                            JM
·330 REM SAVE CURRENT FILE TO DISK              LD
·340 IFEF=.THENPRINT" [s N]O [s F]ILE IN
[s M]EMORY!";:SLEEP5:GOSUB1500:RETURN           PE
·350 WINDOW0,1,39,1,1:PRINT"[HOME][c 8] [
s S][s A][s V][s I][s N][s G] [s F][s I]
[s L][s E] [BLUE]";FT$;CHR$(155);:A$=FT$        MH
·360 SCRATCH"[s I][s F]["+A$:DOPEN#1,"[s
I][s F]["+A$+",W":IFDS>20THENPRINT"[RIGH
T]"DS$;:SLEEP5:GOSUB1500:DCLOSE#1:RETURN        HM
·370 J=EF-1:PRINT#1,RL%;CR$;TL;CR$;J;CR$;
N;CR$;FT$:FORX=1TON:PRINT#1,N$(X);CR$;L%
(X):NEXT                                        OP
·380 FORJ=1TOEF-1:FORI=1TON:PRINT#1,R$(J,
I):NEXTI,J                                      PB
·390 DCLOSE#1                                   GD
·400 GOTO550                                    CK
·410 REM LOAD NEW FILE                          OC
·420 IFEFTHENPRINT" [s F]ILE IN [s M]EMOR
Y!";:SLEEP5:GOSUB1500:RETURN                    CH
·430 WINDOW0,1,39,1,1:PRINT"[c 8] [s F]IL
ENAME [BLUE]";:A=10:GOSUB1560:A$=IN$:PRI
NTCHR$(155)                                     OI
·440 DOPEN#1,"[s I][s F]["+A$+",R"              FD
·450 IFDS>20THENPRINT"[RIGHT]"DS$;:SLEEP5
:GOSUB1500:DCLOSE#1:RETURN                      GG
·460 INPUT#1,RL%,TL,EF,N,FT$                    IN
·470 DIMR$(TL,N),N$(N),L%(N)                    AC
·480 FORI=1TON:INPUT#1,N$(I):INPUT#1,L%(I
)                                               CP
·490 NEXT                                       IA
·500 FORJ=1TOEF                                 NC
·510 FORI=1TON                                  KJ
·520 GET#1,A$:IFA$<>CR$THENR$(J,I)=R$(J,I
```

```
)+A$:GOTO520                                    EI
·530 NEXTI,J:EF=EF+1:CR=1                       OE
·540 DCLOSE#1                                   GD
·550 WINDOW0,1,39,1,1:PRINT"[RIGHT]"DS$;        BN
·560 SLEEP5:GOSUB1500:RETURN                    JH
·570 REM INITIALIZE NEW FILE                    EP
·580 GOSUB1520:IFEFTHENPRINT"[DOWN][DOWN]
 ";MC$:SLEEP5:GOSUB1500:RETURN                  BF
·590 RL%=.:TL=.:PRINT"[c 8] [s F]ILENAME
 [BLUE]";:A=10:GOSUB1560:FT$=IN$                CJ
·600 PRINT"[s N]UMBER OF FIELDS ";:A=2:GO
 SUB1560:N=VAL(IN$):IFN<10RN>20THENPRINTC
 HR$(145)CHR$(27)"J"CHR$(27)"Q";:GOTO600:
 ELSE DIMN$(N),L%(N)                            BC
·610 FORX=1TON:PRINT"[s N]AME [s F]IELD #
 ";X;" ";:A=39:GOSUB1560:N$(X)=IN$              JN
·620 A$="":PRINT"[s L]ENGTH [s F]IELD #";
 X;" ";:A=3:GOSUB1560:A$=IN$:IFVAL(A$)>.A
 NDVAL(A$)<256THENL%(X)=ABS(VAL(A$)):ELSE
 PRINT"[s D]EFAULT (160) !":L%(X)=160           CH
·630 RL%=RL%+L%(X):NEXT                         OF
·640 RL%=RL%+3*(N+1)+5:TL=INT(FRE(1)/RL%)
 :EF=2:DIMR$(TL,N)                              DH
·650 PRINT"[s T]HIS FILE WILL PERMIT AT L
 EAST":PRINT"[RVSON]";INT(FRE(1)/RL%);"[R
 VSOFF][s R]ECORDS.":PRINT"[DOWN][DOWN][R
 VSON][s A][RVSOFF]CCEPT OR [RVSON][s R][
 RVSOFF]EJECT?"                                 AJ
·660 GETKEYA$:IFA$<>"A"ANDA$<>"R"THEN660        DF
·670 IFA$="R"THENCOLLISION1:EF=.:GOSUB150
 0:RUN180:ELSEPRINT"[DOWN][s E]MPTY [s F]
 ILE [s C]REATED.":CR=1:SLEEP5:GOSUB1500:
 RETURN                                         KE
·680 REM DELETE RECORD(S)                       KK
·690 GOSUB1520:IFEF=.THENPRINTM$:SLEEP5:G
 OSUB1500:RETURN:ELSEPRINT"[c 8][RVSON][s
  C][RVSOFF]URRENT [s R]ECORD,[RVSON][s S
 ][RVSOFF]CAN [s F]ILE,OR [RVSON][s A][RV
 SOFF]LL?"                                      IE
·700 GETKEYA$:IFA$<>"C"ANDA$<>"S"ANDA$<>"
 A"THEN700                                      IG
·710 SOUND1,25000,25,0,2000,3000,1              NH
·720 IFA$="A"THENBEGIN:PRINT"[DOWN][DOWN]
 [s D][s E][s L][s E][s T][s E][SS][s A][
 s L][s L][SS][s R][s E][s C][s O][s R][s
  D][s S]![s A][s R][s E][SS][s Y][s O][s
  U][SS][s S][s U][s R][s E]?([s Y]/[s N]
 )":DO:GETKEYA$:LOOPUNTILA$="Y"ORA$="N":I
 FA$="Y"THENEF=.
 :COLLISION1:GOSUB1490:RUN180:ELSE900           MJ
·730 BEND                                       BG
·740 IFA$="C"THENBEGIN                          PH
·750 PRINT"[DOWN][DOWN][s D][s E][s L][s
 E][s T][s I][s N][s G][4"."]":SOUND1,250
 00,15,0,3000,8000,1                            GK
·760 FORI=1TON:R$(CR,I)="":NEXT:FORX=1TOE
 F-1:IFR$(X,1)=""THENFORI=1TON:R$(X,I)=R$
 (X+1,I):R$(X+1,I)="":NEXTI:NEXTX:ELSENEX
 TX                                             GA
·770 IFEF>1ANDEF<>CRTHENEF=EF-1                 HB
·780 PRINT"[DOWN][DOWN][s @] [s R][s E][s
  C][s O][s R][s D][SS]#";CR;"DELETED.":S
 LEEP3:IFA$="[s D]"THENRETURN:ELSEGOTO900       DL
·790 BEND                                       BG
·800 IFA$="S"THENBEGIN                          AH
·810 PRINTCHR$(19)CHR$(19)CHR$(147);:PRIN
 T"[RVSON][BLUE][DOWN][s S][s H][s I][s F
 ][s T]-[s E] TO [s E]XIT,[s S][s H][s I]
 [s F][s T]-[s D] TO [s D][s E][s L][s E]
 [s T][s E] RECORD"                             CO
·820 WINDOW1,2,39,24,1                          DH
·830 DO:PRINTCHR$(147);:GOSUB1540               DL
·840 GETA$:IFJOY(2)=.ANDA$=""THEN840            GO
·850 IFJOY(2)=3THENCR=CR+1:IFCR>EFTHENCR=
 EF                                             DC
·860 IFJOY(2)=7THENCR=CR-1:IFCR<1THENCR=1       AC
·870 IFA$="[s D]"THENGOSUB750                   KB
·880 LOOPUNTILA$="[s E]"                        CB
·890 BEND                                       BG
·900 GOSUB1500:RETURN                           DK
·910 REM VIEW RECORD(S)                         CL
·920 GOSUB1520:IFEF=.THENPRINTM$:SLEEP5:G
 OSUB1500:RETURN                                EH
·930 GOSUB940:GOSUB1500:RETURN                  JA
·940 GOSUB1540:SLEEP1                           NI
·950 IFJOY(2)=.THEN950                          AB
·960 IFJOY(2)>127THENRETURN                     HA
·970 IFJOY(2)=3THENCR=CR+1:IFCR>EFTHENCR=
 EF                                             DC
·980 IFJOY(2)=7THENCR=CR-1:IFCR<1THENCR=1       AC
·990 IFJOY(2)=1THENBEGIN:SOUND1,18000,10,
 1,2000,5000,2:PRINTCHR$(19)CHR$(17);:FOR
 X=1TON:PRINT"[c 8]";N$(X);"[BLUE][RIGHT]
 ";                                             OJ
·1000 A=L%(X+1):IN$=" ":GOSUB1570:IFIN$<>
 " "THENR$(CR,X)=MID$(IN$,2)                    BB
·1010 NEXT:IFCR=EFANDR$(CR,1)<>""THENEF=C
 R+1:IFEF>TLTHENEF=TL                           CK
·1020 BEND                                      BG
·1030 PRINTCHR$(147);:GOTO940                   NE
·1040 REM SORT RECORDS                          AO
·1050 REM ("[s S]HELL [s M]ETZNER [s A]LG
 ORITHM")                                       OJ
·1060 GOSUB1520:IFEF=.THENPRINTM$:SLEEP5:
 GOSUB1500:RETURN                               EH
·1070 DO:PRINT"[c 8][CLEAR][s S]ORT USING
  [s F]IELD?(1 ><";N;")";:INPUTA$:IFA$=""
 THENX=1:EXIT:ELSEX=VAL(A$):LOOPUNTILX>.A
 NDX<=N:M=EF-1:PRINT:PRINT"[DOWN][DOWN][s
  S]TAND BY-[s S]ORTING [s F]ILE!"              JN
·1080 SLEEP3:FAST                               JM
·1090 M=INT(M/2):IFM=.THEN1170                  JP
·1100 K=(EF-1)-M:J=1                            EA
·1110 I=J                                       EA
·1120 COLOR4,(JAND15)+1:L=I+M:IFR$(I,X)<=
 R$(L,X)THEN1150                                AG
```

```
•1130 FORR=1TON:A$=R$(I,R):R$(I,R)=R$(L,R
 ):R$(L,R)=A$:NEXT                         CK
•1140 I=I-M:IFI>=1THEN1120                 HM
•1150 J=J+1:IFJ>KTHEN1090                  NE
•1160 GOTO1110                             FC
•1170 COLOR4,12:SLOW:PRINT"[DOWN][DOWN][s
 @] [s S][s O][s R][s T][SS][s C][s O][s
 M][s P][s L][s E][s T][s E][s D].":SLEE
P5:GOSUB1500:RETURN                        PC
•1180 REM SEARCH RECORDS,FIND STRING       CN
•1190 GOSUB1520:IFEF=.THENPRINTM$:SLEEP5:
GOSUB1500:RETURN                           EH
•1200 WINDOW1,1,39,1,1:PRINT"[c 8][s S]EA
RCH [s S]TRING:[BLUE]";:A=23:GOSUB1560:A
$=IN$                                      AC
•1210 PRINT"[c 8][s S]EARCHING[3"."]";:WI
NDOW1,2,39,24,1:FORJ=1TOEF-1:FORI=1TON:I
FINSTR(R$(J,I),A$)THENCR=J:GOSUB940:CR=J LK
•1220 NEXTI,J:PRINT"[HOME][HOME][CLEAR][c
 8][DOWN][RIGHT][s S]EARCH COMPLETED.";:
SLEEP3:GOSUB1500:RETURN                    OG
•1230 REM HARDCOPY                         OD
•1240 GOSUB1520:IFEF=.THENPRINTM$:SLEEP5:
GOSUB1500:RETURN:ELSEPRINT"[RVSON][BLUE]
 [3"*"][4" "][s L]INE [s R]ANGE FOR [s H
]ARDCOPY[4" "][3"*"] "                     DA
•1250 WINDOW1,3,39,3,1:A$="":INPUT"[c 8][
s F]ROM:";A$:IFA$=""THENF=1:ELSEF=VAL(A$
)                                          OD
•1260 IFF<1ORF>EFTHEN1250                  HG
•1270 WINDOW1,4,39,4,1:A$="":INPUT"[s T]O
:";A$:IFA$=""THENL=EF-1:ELSEL=VAL(A$)      HH
•1280 IFL<1ORL>EFTHEN1270:ELSEIFL<FTHEN12
50                                         PE
•1290 PRINT"[HOME][HOME]":PRINT"[c 8][3"[
DOWN]"][s @] [s P][s R][s I][s N][s T][s
 I][s N][s G] [s F][s I][s L][s E] ";FT$
:GRAPHIC0                                  ED
•1300 OPEN4,4,7:CMD4                       JP
•1310 :                                    DI
•1320 FORJ=FTOL:CR=J:GOSUB1540:PRINT:NEXT MC
•1330 PRINT#4,""                           EK
•1340 CLOSE4,4                             DN
•1350 PRINT"[c 8][3"[DOWN]"][s @] [s D][s
 O][s N][s E].":SLEEP3                     IE
•1360 GOSUB1500:RETURN                     DK
•1370 REM GET RECORD NUMBER IN I           NO
•1380 IFEF=.THENRETURN                     DO
•1390 IFJOY(2)THEN1390                     FH
•1400 GOSUB1480                            GC
•1410 IFJOY(2)=3THENCR=CR+1                BN
•1420 IFJOY(2)=5THENCR=CR-10               FK
•1430 IFJOY(2)=7THENCR=CR-1                EI
•1440 IFJOY(2)=1THENCR=CR+10               HB
•1450 IFCR<1THENCR=1:ELSEIFCR>EFTHENCR=EF FE
•1460 IFJOY(2)>127THENMOVSPR1,160,150:RET
URN                                        GL
•1470 GOTO1400                             FO
•1480 COLOR1,16:CHAR1,32,18,"[6" "]":IFEF
THENA$=STR$(CR):CHAR1,32,18,A$:RETURN:EL
SERETURN                                   HP
•1490 REM SWITCH BACK TO COMMAND SCREEN     GG
•1500 GRAPHIC2,0,25:MOVSPR1,160,150:POKEV
+21,255:CHAR1,23,22,"[6" "]":GOSUB1480:I
FEFTHENA$=STR$(INT(FRE(1)/RL%)):CHAR1,22
,22,A$:RETURN:ELSE RETURN                  PB
•1510 REM SWITCH TO TEXT                   GB
•1520 PRINTCHR$(19)CHR$(19)CHR$(147):WIND
OW 1,1,39,24,1:GRAPHIC2,0,1:POKEV+21,0:R
ETURN                                      ED
•1530 REM CHROUT ONE RECORD                AE
•1540 PRINT"[c 8][RVSON] [s R][s E][s C][
s O][s R][s D][SS]#";CR;"IN [s F][s I][s
 L][s E][SS]";FT$:FORX=1TON:PRINT"[c 8]"
;N$(X);": ";"[BLUE]";R$(CR,X):NEXT:RETUR
N                                          CP
•1550 REM TAMPERPROOF INPUT                KE
•1560 PRINTCHR$(27);"Q";:IN$=""            OA
•1570 POKE208,.:POKE244,1                  DH
•1580 GETZ$:Z=ASC(Z$):IFZ=.OR(Z>95ANDZ<19
3)ORZ>218THENPOKE244,.:PRINT"[RVSON] [LE
FT][RVSOFF]";:POKE244,1:GOTO1580           CJ
•1590 ZL=LEN(IN$):IFZL=ATHEN1610           PN
•1600 IFZ>31THENIN$=IN$+Z$:PRINTZ$;CHR$(2
7)"Q";:GOTO1580                            JM
•1610 IFZ=13ANDZLTHENPOKE204,1:PRINT" ":R
ETURN                                      JH
•1620 IFZ=20ANDZLTHENIN$=LEFT$(IN$,ZL-1):
POKE244,.:PRINT" [LEFT][LEFT] [LEFT]";:P
OKE244,1                                   CH
•1630 GOTO1580                             FP
•1640 REM INTERRUPT PROCESSING             KE
•1650 G=BUMP(1)AND254:IFG=0THENRETURN      OL
•1660 FORX=1TO7:IFBO(X)=GTHENC=X:O=G:G=BU
MP(1):NEXT:ELSENEXT                        DI
•1670 RETURN                               IM
•1680 REM ERROR TRAPPING                   JC
•1690 COLLISION1,1650:IFER=30THENRESUME    DB
•1700 IFER=5ANDEL=1290THENPRINT"[3"[DOWN]
"] [s A][s B][s O][s R][s T][s I][s N][s
 G] [s H][s A][s R][s D][s C][s O][s P][
s Y].[s P][s R][s I][s N][s T][s E][s R]
 [s O][s F][s F][SS][s L][s I][s N][s E]
!":SLEEP3:GOSUB1500:RETURN                 GG
•1710 IFER=5THENPRINT"[3"[DOWN]"] [s D][s
 E][s V][s I][s C][s E] [s N][s O][s T]
[s P][s R][s E][s S][s E][s N][s T]!";:S
LEEP3:GOSUB1500:RETURN                     AJ
•1720 IFER<9THENPRINTCHR$(19)CHR$(19);DS$
;:RESUME                                   OK
•1730 IFER=24THENPRINT"[3"[DOWN]"] [s F][
s I][s L][s E][SS][s D][s A][s T][s A][S
S][s E][s R][s R][s O][s R].";:SLEEP5:GO
SUB1500:RETURN                             EL
•1740 PRINTERR$(ER);" ERROR IN ";EL:SLOW:
GOSUB1500:END                              EK
```

```
1750 REM SPRITE DATA                 IB
1760 DATA0,0,0,0,0,0                 JC
1770 DATA0,0,0,3,255,128             FE
1780 DATA2,1,0,2,2,0                 JL
1790 DATA2,4,0,2,2,0                 JE
1800 DATA2,1,0,2,0,128               CH
1810 DATA2,96,64,2,144,32            LM
1820 DATA3,8,16,0,4,8                OF
1830 DATA0,2,4,0,1,2                 JL
1840 DATA0,0,129,0,0,65              CN
1850 DATA0,0,34,0,0,20               PO
1860 DATA0,0,8,0,0,0                 JK
1870 DATA0,7,255,240,7,227           PA
1880 DATA240,7,221,224,7,221         FE
1890 DATA240,7,221,240,7,227         JA
1900 DATA240,7,255,240,7,247         AH
1910 DATA240,7,247,240,7,247         FO
1920 DATA240,7,255,240,0,0           MO
1930 DATA0,255,255,255,198,0         AC
1940 DATA3,197,255,227,197,64        NH
1950 DATA35,197,255,227,192,0        KP
1960 DATA3,255,255,255,0,0           NO
1970 DATA0,0,128,0,0,64              FN
1980 DATA0,0,36,15,255,20            LI
1990 DATA16,3,12,32,5,124            GB
2000 DATA64,9,0,255,241,0            ID
2010 DATA128,17,0,143,17,0           JA
2020 DATA128,17,0,255,241,0          CO
2030 DATA128,17,0,143,17,0           JA
2040 DATA128,17,0,128,17,0           LD
2050 DATA255,241,0,128,17,0          GG
2060 DATA128,17,0,143,18,0           JF
2070 DATA128,20,0,255,248,0          OH
2080 DATA0,0,0,0,0,0                 JC
2090 DATA0,60,0,0,66,0               BN
2100 DATA3,255,192,4,0,32            HL
2110 DATA3,255,192,2,0,64            JI
2120 DATA2,82,64,2,82,64             HC
2130 DATA2,82,64,2,82,64             HC
2140 DATA2,82,64,2,82,64             HC
2150 DATA2,82,64,2,82,64             HC
2160 DATA2,82,64,2,0,64              DE
2170 DATA3,255,192,0,0,0             GP
2180 DATA0,0,0,0,0,0                 JC
2190 DATA0,0,0,0,0,0                 JC
2200 DATA0,0,0,0,0,255               PJ
2210 DATA0,3,0,192,4,60              DD
2220 DATA32,8,66,16,16,153           BB
2230 DATA8,32,189,4,16,153           MC
2240 DATA8,8,66,16,4,60              EP
2250 DATA32,3,0,192,0,255            ID
2260 DATA0,0,0,0,0,0                 JC
2270 DATA0,0,0,0,0,0                 JC
2280 DATA0,0,0,0,0,0                 JC
2290 DATA0,255,0,0,8,15              CC
2300 DATA255,20,16,3,34,32           OP
2310 DATA5,62,64,9,34,255            HM
2320 DATA241,34,128,17,0,143         OD
2330 DATA17,60,128,17,34,255         AG
2340 DATA241,34,128,17,60,143        GK
2350 DATA17,34,128,17,34,128         GO
2360 DATA17,60,255,241,0,128         NM
2370 DATA17,28,128,17,34,143         JG
2380 DATA18,32,128,20,32,255         HE
2390 DATA248,34,0,0,28,255           KC
2400 DATA0,0,0,0,0,0                 JC
2410 DATA15,128,0,1,131,255          DD
2420 DATA2,130,1,4,130,1             CG
2430 DATA8,0,1,16,63,225             HK
2440 DATA32,32,63,64,32,32           CK
2450 DATA128,0,32,7,252,32           OG
2460 DATA4,7,224,4,4,0               PK
2470 DATA0,4,0,255,132,0             DK
2480 DATA128,252,0,128,128,0         PM
2490 DATA128,128,0,128,128,0         GO
2500 DATA255,128,0,255,0,0           PE
2510 DATA0,0,127,255,0,64            KD
2520 DATA1,0,94,1,0,64               BM
2530 DATA1,0,95,253,0,64             GN
2540 DATA1,16,95,253,8,64            KP
2550 DATA1,252,95,253,8,64           PB
2560 DATA1,16,95,253,0,64            KH
2570 DATA1,0,95,253,0,64             GN
2580 DATA1,0,95,253,0,64             GN
2590 DATA1,0,64,1,0,127              FM
2600 DATA255,0,0,0,0,0               BJ
2610 DATA0,255,7,6,10,7              FD
2620 REM HIRES SHAPE DATA            GG
2630 DATA192,000,000,191,000,000,129,015 JN
2640 DATA255,129,016,003,129,032,005,255 OK
2650 DATA064,009,000,255,241,000,128,081 AM
2660 DATA033,000,145,115,255,049,170,001 ND
2670 DATA081,034,057,145,035,255,017,032 NJ
2680 DATA128,017,032,128,017,032,255,241 AN
2690 DATA032,128,017,000,128,017,000,143 FL
2700 DATA018,000,128,020,000,255,248,000 PM
2710 REM ICON LOCATIONS              HG
2720 DATA45,70,120,70,205,70,290,70,45,1
     50                              BO
2730 DATA120,150,215,150             FL
```

SCRAMBLER
FROM PAGE 31

Starting address in hex: C000
Ending address in hex: CA61
SYS to start: 49152

Flankspeed **required for entry! See page 95.**

```
C000: A9 D3 A0 C5 20 1E AB 20 ED
C008: 8D C4 A9 20 85 39 A9 CA 57
C010: 85 3A A9 00 85 3B A9 3F 23
C018: 85 3C A2 04 A0 3F B1 39 4B
C020: 91 3B 88 C0 FF D0 F7 C6 C5
C028: 3A C6 3C CA D0 F0 A0 3F D1
C030: A9 00 99 40 3F 88 10 FA 86
C038: 8C 56 3F A0 18 B9 B4 C6 48
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C040: 99 00 D4 88 10 F7 A2 18 F9
C048: A0 02 18 20 F0 FF A9 D7 95
C050: A0 C5 20 1E AB A9 00 8D D7
C058: 20 D0 8D 21 D0 8D 17 D0 3E
C060: 8D 1B D0 8D 1D D0 A9 7F 7E
C068: 8D 1C D0 A9 0A 8D 27 D0 1C
C070: A9 07 8D 25 D0 A9 09 8D E4
C078: 26 D0 A9 01 8D 2E D0 78 1F
C080: A9 DD 8D 14 03 A9 C4 8D A8
C088: 15 03 58 A9 33 8D D7 07 42
C090: 20 C7 C3 A9 11 8D 20 C6 6B
C098: A9 01 8D 1F C6 20 F4 C3 8F
C0A0: A9 00 85 FE 8D 26 C6 8D D6
C0A8: 27 C6 8D 22 C6 8D 28 C6 89
C0B0: 8D 29 C6 8D 04 D4 8D 0B 2D
C0B8: D4 8D 0F D0 8D 25 C6 A9 1E
C0C0: DE 8D 23 C6 A2 05 8A 0A 53
C0C8: A8 BD 7E C6 99 03 D0 AD 8F
C0D0: 1B D4 09 08 9D 28 D0 09 71
C0D8: B0 9D 38 C6 A9 00 9D 3F AC
C0E0: C6 A9 FC 9D F9 07 20 5F 6C
C0E8: C2 CA 10 DA 20 4E C3 A9 3D
C0F0: FD 8D FF 07 A9 FF 8D 15 CF
C0F8: D0 A2 14 8E 24 C6 18 A5 B7
C100: A2 69 02 C5 A2 D0 FC 8A CE
C108: 29 07 4A 09 F4 8D F8 07 0E
C110: E8 E0 29 90 E6 AD 1E D0 17
C118: E6 FD 20 E7 C2 AD 8D 02 05
C120: 8D 1F C6 F0 12 A9 00 8D CD
C128: 18 D4 AD 8D 02 D0 FB 8D AC
C130: 1F C6 A9 8F 8D 18 D4 AD 77
C138: 22 C6 F0 09 CE 22 C6 20 F2
C140: A7 C3 4C 48 C1 20 73 C3 59
C148: 20 2B C2 20 72 C2 20 4E 1A
C150: C3 A5 FD 29 07 D0 09 AD 6F
C158: 1B D4 8D 0A 3F 8D 1C 3F 08
C160: AE 20 C6 A0 00 C8 D0 FD 2E
C168: CA D0 FA AD 1E D0 29 01 C5
C170: D0 20 AD 23 C6 C9 30 B0 A3
C178: 9F AC 20 C6 88 C0 06 90 8B
C180: 03 8C 20 C6 AC D7 07 C8 4B
C188: C0 3A B0 03 8C D7 07 4C EE
C190: 98 C0 A9 7F 8D 15 D0 8D 14
C198: 1F C6 AD 22 C6 F0 09 CE DD
C1A0: 22 C6 20 B2 C3 4C 9A C1 C8
C1A8: 8D 04 D4 85 3A AD F8 07 7C
C1B0: 85 39 A0 06 06 39 26 3A B5
C1B8: 88 D0 F9 A0 3F B1 39 99 70
C1C0: C0 3F 88 10 F8 8C F8 07 DE
C1C8: A0 54 8C 0B D4 C8 8C 0B 8A
C1D0: D4 A0 3F A2 00 A9 00 9D 6F
C1D8: C0 3F A5 A2 C5 A2 F0 FC 77
C1E0: 18 8A 69 0B 29 3F AA 8D 98
C1E8: 08 D4 88 10 E8 CE D7 07 F4
C1F0: AD D7 07 29 0F F0 03 4C F5
C1F8: 98 C0 A9 00 85 C6 A2 04 EE
C200: A0 0E 18 20 F0 FF EE 86 4D
C208: 02 A0 00 B9 11 C6 F0 EE 1C
C210: 20 D2 FF A5 A2 C5 A2 F0 A4
C218: FC 84 FB 20 E4 FF C9 00 64
C220: D0 06 A4 FB C8 4C 0B C2 7A
C228: 4C 8B C0 A2 05 18 BD 38 76
C230: C6 7D 2A C6 A8 BD 3F C6 D1
C238: 7D 31 C6 85 FB D0 0A C0 CA
C240: 28 B0 0A 20 5F C2 4C 5B 0D
C248: C2 C0 32 B0 F6 AD 1B D4 43
C250: F0 F1 98 9D 38 C6 A5 FB 0A
C258: 9D 3F C6 CA 10 CF 60 AD B4
C260: 1B D4 29 07 A8 B9 6A C6 14
C268: 9D 2A C6 B9 72 C6 9D 31 B8
C270: C6 60 AD 0F D0 D0 45 AD E8
C278: 1B D4 D0 6A AD 23 C6 A2 DD
C280: 05 DD 7E C6 F0 04 CA 10 78
C288: F8 60 8D 0F D0 A0 01 78 69
C290: 38 BD 38 C6 8D 3E C6 ED 06
C298: 24 C6 BD 3F C6 8D 45 C6 E0
C2A0: ED 25 C6 90 01 88 58 B9 A6
C2A8: 7A C6 8D 30 C6 B9 7C C6 6B
C2B0: 8D 37 C6 A0 54 8C 0B D4 9D
C2B8: C8 8C 0B D4 18 AD 3E C6 B8
C2C0: 6D 30 C6 A8 AD 45 C6 6D F4
C2C8: 37 C6 30 06 F0 0A C0 55 0E
C2D0: 90 06 A9 00 8D 0F D0 60 DE
C2D8: 8C 3E C6 8D 45 C6 98 29 C5
C2E0: 0F 09 40 8D 08 D4 60 A9 AD
C2E8: 00 85 A7 A9 04 85 A8 38 2A
C2F0: AD 23 C6 E9 27 4A 4A 4A 78
C2F8: A8 F0 10 18 A5 A7 69 28 99
C300: 85 A7 A5 A8 69 00 85 A8 13
C308: 88 D0 F0 78 38 AD 24 C6 9B
C310: E9 11 85 FB AD 25 C6 E9 10
C318: 00 58 4A 66 FB 46 FB 46 A5
C320: FB A4 FB B1 A7 85 FE C9 64
C328: 45 D0 22 A9 20 91 A7 A9 0D
C330: 00 8D 29 C6 38 A9 12 ED 8F
C338: 20 C6 85 FB 0A 0A 18 65 32
C340: FB 8D 22 C6 A0 40 8C 04 24
C348: D4 C8 8C 04 D4 60 A2 06 54
C350: 8A 0A A8 BD 38 C6 99 02 E5
C358: D0 AD 10 D0 3D 5C C6 A8 C0
C360: BD 3F C6 29 01 F0 05 98 DC
C368: 1D 63 C6 A8 8C 10 D0 CA 90
C370: 10 DE 60 AD 29 C6 F0 04 52
C378: CE 29 C6 60 AC 28 C6 B9 EC
C380: CD C6 D0 04 8D 28 C6 60 C6
C388: 8D 29 C6 A2 40 8E 04 D4 50
C390: B9 EA C6 F0 0D 8D 01 D4 5D
C398: B9 DC C6 8D 00 D4 E8 8E CF
C3A0: 04 D4 C8 8C 28 C6 60 29 47
C3A8: 01 0A 0A 0A 0A 09 20 8D 88
C3B0: 01 D4 A0 04 38 B9 C8 07 EC
C3B8: 69 00 C9 3A 90 02 A9 30 92
C3C0: 99 C8 07 88 10 EF 60 A0 B3
C3C8: 00 B9 C8 07 D9 E0 07 F0 05
C3D0: 05 B0 0B 4C E9 C3 C8 C0 15
C3D8: 06 90 EE 4C E9 C3 A0 05 FD
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C3E0: B9 C8 07 99 E0 07 88 10 84
C3E8: F7 A0 05 A9 30 99 C8 07 C9
C3F0: 88 10 FA 60 A9 17 85 FB 27
C3F8: A6 FB 20 FF E9 C6 FB 10 78
C400: F7 A9 04 85 FB A6 FB BD 87
C408: 46 C6 85 02 85 04 BD 4B 2F
C410: C6 85 03 18 69 D4 85 05 40
C418: A0 4B A9 41 91 02 A9 06 32
C420: 91 04 88 C0 28 B0 F3 AD 79
C428: 1B D4 29 23 A8 A9 45 91 8D
C430: 02 A9 05 91 04 C6 FB 10 49
C438: CC A9 07 85 FB A6 FB BC 96
C440: 84 C6 BD 8C C6 AA 18 20 7F
C448: F0 FF A9 02 A0 C6 20 1E 8A
C450: AB C6 FB 10 E8 A0 27 A9 29
C458: 44 99 98 07 A9 02 99 98 B3
C460: DB 88 10 F3 A0 50 A9 43 A6
C468: 99 14 04 A9 0B 99 14 D8 55
C470: 38 98 E9 28 A8 10 EF A9 A5
C478: 13 20 D2 FF A9 05 20 D2 20
C480: FF 38 A9 12 ED 20 C6 AA F3
C488: A9 00 4C CD BD AD 0E DC A2
C490: 29 FE 8D 0E DC A5 01 29 01
C498: FB 85 01 A9 D0 85 3A A9 FE
C4A0: 38 85 3C A0 00 84 39 84 7D
C4A8: 3B A2 04 B1 39 91 3B C8 0B
C4B0: D0 F9 E6 3A E6 3C CA D0 5B
C4B8: F2 A5 01 09 04 85 01 AD 93
C4C0: 0E DC 09 01 8D 0E DC AD DB
C4C8: 18 D0 29 F0 09 0E 8D 18 88
C4D0: D0 A0 27 B9 F8 C6 99 08 84
C4D8: 3A 88 10 F7 60 AD 1F C6 97
C4E0: F0 03 4C B9 C5 AC 27 C6 3B
C4E8: D0 26 AD 00 DC AA 29 10 4E
C4F0: D0 35 AD F8 07 C9 F8 B0 18
C4F8: 2E A8 8A 29 0C 4A 4A 8D B1
C500: 21 C6 AA BD 58 C6 D0 01 41
C508: 98 09 03 8D F8 07 A0 00 DA
C510: 18 AD 23 C6 79 94 C6 8D 22
C518: 23 C6 C8 98 29 1F 8D 27 60
C520: C6 AE 21 C6 4C 98 C5 8A B2
C528: 29 03 AA AD 26 C6 D0 19 83
C530: BD 50 C6 F0 3E A5 FE E0 B9
C538: 01 D0 07 C9 42 F0 07 4C 61
C540: 73 C5 C9 43 D0 2D EE 26 99
C548: C6 A5 A2 29 01 D0 1C 18 86
C550: AD 23 C6 7D 50 C6 8D 23 2D
C558: C6 A0 05 D9 7E C6 F0 0E E2
C560: 88 10 F8 29 07 4A 09 F8 6E
C568: 8D F8 07 4C B9 C5 A9 00 6B
C570: 8D 26 C6 AD 00 DC 29 0C AA
C578: 4A 4A AA BD 58 C6 D0 0B 70
C580: AD F8 07 29 FC 8D F8 07 E1
C588: 4C B9 C5 AD 24 C6 29 0F 25
C590: 4A 4A 1D 58 C6 8D F8 07 EE
C598: 18 AD 24 C6 7D 50 C6 A8 86
C5A0: AD 25 C6 7D 54 C6 D0 07 AA
C5A8: C0 22 90 0D 4C B3 C5 C0 AF
C5B0: 41 B0 06 8C 24 C6 8D 25 D2
C5B8: C6 AD 23 C6 8D 01 D0 AD 24
C5C0: 24 C6 8D 00 D0 AD 10 D0 98
C5C8: 29 FE 0D 25 C6 8D 10 D0 58
C5D0: 4C 31 EA 8E 08 93 00 9F 03
C5D8: 53 43 4F 52 45 20 05 30 AB
C5E0: 30 30 30 30 30 20 20 20 32
C5E8: 9C 4C 49 56 45 53 20 05 2F
C5F0: 33 20 20 20 1E 48 49 47 7B
C5F8: 48 20 05 30 30 30 30 30 57
C600: 30 00 97 C2 11 9D C2 11 0D
C608: 9D C2 11 9D C2 11 9D C3 4C
C610: 00 50 52 45 53 53 20 41 FF
C618: 4E 59 20 4B 45 59 00 00 C9
C620: 00 00 00 00 00 00 00 00 20
C628: 00 00 00 00 00 00 00 00 28
C630: 00 00 00 00 00 00 00 00 30
C638: 00 00 00 00 00 00 00 00 38
C640: 00 00 00 00 00 00 D2 32 45
C648: 92 F2 52 06 06 05 04 04 39
C650: 00 01 FF 00 00 00 FF 00 51
C658: 00 F4 F0 00 FD FB F7 EF 20
C660: DF BF 7F 02 04 08 10 20 BD
C668: 40 80 01 FF 02 FE 03 FD 2C
C670: 01 FF 00 FF 00 FF 00 FF 71
C678: 00 FF FC 04 FF 00 3E 5E 16
C680: 7E 9E BE DE 09 1F 14 09 80
C688: 1F 14 09 1F 02 02 06 0A F7
C690: 0A 0E 12 12 FE FE FE FE C8
C698: FF FF 00 FF 00 FF 00 00 98
C6A0: FF 00 00 00 00 00 00 01 A1
C6A8: 00 00 01 00 01 00 01 01 AC
C6B0: 02 02 02 02 00 00 00 08 C0
C6B8: 00 50 84 3E 00 C8 00 00 94
C6C0: 0C 00 FF FF 00 00 80 00 4D
C6C8: 00 00 00 00 8F 14 0A 0A 80
C6D0: 0A 0A 0A 0A 14 0A 0A 0A 2B
C6D8: 0A 0A 0A 00 47 B4 47 00 3A
C6E0: 47 98 47 47 B4 47 00 30 7B
C6E8: 47 B4 05 04 05 00 05 05 FC
C6F0: 05 05 04 05 00 04 05 04 11
C6F8: 00 FF 00 7E 18 7E 00 FF 0E
C700: 81 BD 81 81 81 BD 81 81 84
C708: 81 BD 81 81 81 BD 81 81 8C
C710: 00 FB FB 00 DF DF 00 00 C7
C718: 00 3C 18 3C 7E FF FF 7E A5
C720: 00 00 00 02 80 00 02 80 25
C728: 00 00 00 00 01 50 00 09 82
C730: 50 00 00 80 00 03 C0 00 C4
C738: 03 C0 00 03 C0 00 00 C0 80
C740: 00 03 C0 00 00 00 00 00 04
C748: 00 00 00 00 00 00 00 00 48
C750: 00 00 00 00 00 00 00 00 50
C758: 00 00 00 00 00 00 00 00 58
C760: 00 00 00 02 80 00 02 80 65
C768: 00 00 00 00 01 40 00 01 AA
C770: 40 00 02 00 00 00 C0 00 73
C778: 03 C0 00 03 F0 00 00 F0 21
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C780: 00 00 C0 00 00 00 00 00 41
C788: 00 00 00 00 00 00 00 00 88
C790: 00 00 00 00 00 00 00 00 90
C798: 00 00 00 00 00 00 00 00 98
C7A0: 00 00 00 02 80 00 02 80 A5
C7A8: 00 00 00 00 01 50 00 09 03
C7B0: 60 00 00 00 00 0F C0 00 E0
C7B8: 0F C0 00 0C C0 00 3C F0 82
C7C0: 00 00 30 00 00 00 00 00 F0
C7C8: 00 00 00 00 00 00 00 00 C8
C7D0: 00 00 00 00 00 00 00 00 D0
C7D8: 00 00 00 00 00 00 00 00 D8
C7E0: 00 00 00 02 80 00 02 80 E5
C7E8: 00 00 10 00 01 54 00 25 73
C7F0: 48 00 00 00 00 03 C0 00 FC
C7F8: 0F C0 00 3C FC 00 30 0C 3E
C800: 00 F0 00 00 00 00 00 00 F0
C808: 00 00 00 00 00 00 00 00 08
C810: 00 00 00 00 00 00 00 00 10
C818: 00 00 00 00 00 00 00 00 18
C820: 00 00 00 0A 00 00 0A 00 34
C828: 00 00 00 00 15 00 00 15 52
C830: 80 00 08 00 00 0F 00 00 C7
C838: 0F 00 00 0F 00 00 0C 00 62
C840: 00 0F 00 00 00 00 00 00 4F
C848: 00 00 00 00 00 00 00 00 48
C850: 00 00 00 00 00 00 00 00 50
C858: 00 00 00 00 00 00 00 00 58
C860: 00 00 00 0A 00 00 0A 00 74
C868: 00 00 00 00 05 00 00 05 72
C870: 00 00 02 00 00 0C 00 00 7E
C878: 0F 00 00 3F 00 00 3C 00 03
C880: 00 0C 00 00 00 00 00 00 8C
C888: 00 00 00 00 00 00 00 00 88
C890: 00 00 00 00 00 00 00 00 90
C898: 00 00 00 00 00 00 00 00 98
C8A0: 00 00 00 0A 00 00 0A 00 B4
C8A8: 00 00 00 00 15 00 00 25 E2
C8B0: 80 00 00 00 00 0F C0 00 01
C8B8: 0F C0 00 0C C0 00 3C F0 82
C8C0: 00 30 00 00 00 00 00 00 F0
C8C8: 00 00 00 00 00 00 00 00 C8
C8D0: 00 00 00 00 00 00 00 00 D0
C8D8: 00 00 00 00 00 00 00 00 D8
C8E0: 00 00 00 0A 00 00 0A 00 F4
C8E8: 00 10 00 00 55 00 00 85 D3
C8F0: 60 00 00 00 00 0F 00 00 60
C8F8: 0F C0 00 FC F0 00 C0 30 A7
C900: 00 00 3C 00 00 00 00 00 3C
C908: 00 00 00 00 00 00 00 00 08
C910: 00 00 00 00 00 00 00 00 10
C918: 00 00 00 00 00 00 00 00 18
C920: 00 00 00 0A 00 00 0A 00 34
C928: 00 00 20 00 15 50 00 05 B2
C930: 00 00 00 00 00 0F C0 00 FF
C938: 0C 00 00 0C C0 00 0C 00 1D
C940: 00 0C 00 00 00 00 00 00 4C
C948: 00 00 00 00 00 00 00 00 48
C950: 00 00 00 00 00 00 00 00 50
C958: 00 00 00 00 00 00 00 00 58
C960: 00 00 00 0A 00 00 0A 00 74
C968: 00 20 00 00 15 00 00 05 A2
C970: 80 00 00 00 00 0F C0 00 C0
C978: 0C C0 00 0C C0 00 0C C0 DE
C980: 00 00 C0 00 00 00 00 00 41
C988: 00 00 00 00 00 00 00 00 88
C990: 00 00 00 00 00 00 00 00 90
C998: 00 00 00 00 00 00 00 00 98
C9A0: 00 00 00 02 80 00 02 80 A5
C9A8: 00 20 00 00 15 50 00 01 2F
C9B0: 40 00 00 00 00 0F C0 00 C0
C9B8: 00 C0 00 0C C0 00 00 C0 07
C9C0: 00 00 C0 00 00 00 00 00 81
C9C8: 00 00 00 00 00 00 00 00 C8
C9D0: 00 00 00 00 00 00 00 00 D0
C9D8: 00 00 00 00 00 00 00 00 D8
C9E0: 00 00 00 02 80 00 02 80 E5
C9E8: 00 00 20 00 01 50 00 09 63
C9F0: 40 00 00 00 00 0F C0 00 01
C9F8: 0C C0 00 0C C0 00 0C C0 5F
CA00: 00 0C 00 00 00 00 00 00 0C
CA08: 00 00 00 00 00 00 00 00 08
CA10: 00 00 00 00 00 00 00 00 10
CA18: 00 00 00 00 00 00 00 00 18
CA20: 00 00 00 00 00 00 00 AA CA
CA28: 00 01 00 40 00 AA 00 00 14
CA30: 00 00 10 28 04 37 AA DC 2B
CA38: 01 AA 40 3E 00 BC 03 AA CC
CA40: C0 FC 00 3F CC 00 33 00 3D
CA48: 00 00 00 00 00 00 00 00 48
CA50: 00 00 00 00 00 00 00 00 50
CA58: 00 00 00 00 00 00 00 00 58
CA60: FF 00 60
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PIEMAN

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Starting address in hex: C000
Ending address in hex: CA22
SYS to start: 49152

Flankspeed **required for entry! See page 95.**

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C000: 20 CB C4 20 CC C7 20 7F 05
C008: C0 A9 00 8D 00 DC 20 3D 3A
C010: C1 AD 00 DC C9 6F D0 F6 5D
C018: A2 00 A9 2D 9D 9E 07 A9 7E
C020: 0E 9D 9E DB E8 E0 13 D0 F3
C028: F1 20 4B C3 20 92 C0 20 DC
C030: 3D C1 20 A8 C1 A9 00 8D F0
C038: 54 C0 20 9F C2 EE 54 C0 D3
C040: AD 54 C0 C9 01 D0 F3 AD 40
C048: 9B C0 C9 1E D0 03 4C 55 02
C050: C0 4C 29 C0 00 20 7F C0 A7
C058: A2 00 BD 08 CA 9D 3E 04 6B
C060: A9 03 9D 3E D8 E8 E0 06 91
C068: D0 F0 A9 00 8D 00 DC AD EB
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C070: 00 DC C9 6F D0 F9 20 CB 3D
C078: C4 20 CC C7 4C 29 C0 A2 CA
C080: 00 BD 0E CA 9D 9E 07 A9 04
C088: 01 9D 9E DB E8 E0 13 D0 4F
C090: F0 60 A5 A2 69 02 C5 A2 FD
C098: D0 FC 60 00 AD E1 05 EE 4A
C0A0: 9B C0 C9 20 F0 3A EE E1 E2
C0A8: C0 AD E1 C0 20 D9 C0 8D 02
C0B0: E1 C0 EE E6 C0 AD E6 C0 3F
C0B8: 20 D9 C0 8D E6 C0 EE EB 83
C0C0: C0 AD EB C0 20 D9 C0 8D 24
C0C8: EB C0 EE F0 C0 AD F0 C0 75
C0D0: 20 D9 C0 8D F0 C0 4C E0 F7
C0D8: C0 C9 40 D0 02 A9 3C 60 BC
C0E0: A9 3C 8D E1 05 A9 3D 8D AF
C0E8: E2 05 A9 3E 8D 09 06 A9 FE
C0F0: 3F 8D 0A 06 A9 03 8D 05 0D
C0F8: D4 8D 06 D4 A9 EF 8D 17 74
C100: D4 A9 2F 8D 18 D4 A0 0A D2
C108: A9 21 8D 04 D4 A9 05 8D 75
C110: 01 D4 8C 16 D4 A2 00 E8 E8
C118: E0 00 D0 FB A9 20 8D 04 21
C120: D4 18 98 69 05 A8 C0 6E EB
C128: D0 DE A9 8F 8D 18 D4 A9 35
C130: 00 8D 17 D4 8D 04 D4 20 30
C138: 9A C4 60 00 00 EE 3B C1 E3
C140: AD 3B C1 C9 04 D0 34 A9 67
C148: 00 8D 3B C1 AD 3C C1 F0 6F
C150: 2B CE 3C C1 A2 00 BD 1A C2
C158: C9 9D 00 04 9D 50 04 E8 9E
C160: E0 28 D0 F2 A9 3B 8D 28 C7
C168: 04 A9 3A 8D 4F 04 A2 00 D3
C170: BD BB C9 9D 6D 05 E8 E0 8D
C178: 1A D0 F5 60 EE 3C C1 A2 49
C180: 00 BD 42 C9 9D 00 04 9D 89
C188: 50 04 E8 E0 28 D0 F2 A9 3C
C190: 3A 8D 28 04 A9 3B 8D 4F 46
C198: 04 A2 00 BD D5 C9 9D 6D A7
C1A0: 05 E8 E0 1A D0 F5 60 02 B2
C1A8: AD A7 C1 F0 13 C9 01 F0 7F
C1B0: 10 CE 03 D0 AD 03 D0 C9 AE
C1B8: E7 B0 05 A9 00 8D A7 C1 F6
C1C0: 60 EE 03 D0 EE 03 D0 AD 54
C1C8: 03 D0 8D 01 D0 C9 FB 90 52
C1D0: EF 18 AD 15 D0 09 01 8D 04
C1D8: 15 D0 20 8E C2 AD 8D C2 2E
C1E0: 8D 02 D0 A9 02 8D A7 C1 E3
C1E8: 4C C0 C1 AD 05 D0 C9 72 77
C1F0: B0 0C AD 1E D0 C9 0C F0 11
C1F8: 1A C9 14 F0 2F 60 AD 05 24
C200: D0 C9 C8 B0 01 60 AD 1E 41
C208: D0 C9 07 F0 38 A9 00 8D 0A
C210: 1E D0 60 AD 8B C2 C9 00 25
C218: D0 01 60 38 AD 15 D0 E9 FF
C220: 08 8D 15 D0 A9 00 8D 8B 5E
C228: C2 4C 63 C2 AD 8C C2 C9 24
C230: 00 D0 01 60 38 AD 15 D0 2E
C238: E9 10 8D 15 D0 A9 00 8D DC
C240: 8C C2 4C 63 C2 AD A7 C1 19
C248: F0 03 4C 85 C2 A9 00 8D 08
C250: 49 C3 20 2E C4 20 57 C4 AC
C258: A9 E2 8D FA 07 A9 01 8D AC
C260: A7 C1 60 A9 01 8D 49 C3 6F
C268: 18 AD 15 D0 09 01 8D 15 C0
C270: D0 AD 04 D0 8D 00 D0 18 3A
C278: AD 05 D0 69 08 8D 01 D0 CC
C280: A9 E3 8D FA 07 A9 00 8D D4
C288: 1E D0 60 01 01 00 AD 1B A2
C290: D4 C9 2C 90 F9 C9 E6 B0 47
C298: F5 8D 8D C2 60 00 00 AD 7A
C2A0: 9D C2 C9 DE F0 41 CE 06 B0
C2A8: D0 AD 06 D0 C9 33 B0 08 B3
C2B0: EE 07 D0 A9 E1 8D FB 07 93
C2B8: EE 9D C2 AD 9D C2 C9 DE BE
C2C0: D0 20 AD 8B C2 C9 00 F0 68
C2C8: 03 20 9C C0 18 AD 15 D0 F4
C2D0: 09 08 8D 15 D0 A9 6B 8D F7
C2D8: 07 D0 A9 F5 8D 06 D0 4C 01
C2E0: E7 C2 C9 6E B0 01 60 AD 83
C2E8: 9E C2 C9 DE F0 39 CE 08 F3
C2F0: D0 AD 08 D0 C9 33 B0 08 FD
C2F8: EE 09 D0 A9 E1 8D FC 07 DE
C300: EE 9E C2 AD 9E C2 C9 DE 08
C308: D0 3E AD 8C C2 C9 00 F0 CE
C310: 03 20 9C C0 18 AD 15 D0 3C
C318: 09 10 8D 15 D0 A9 6B 8D 47
C320: 09 D0 A9 F5 8D 08 D0 18 18
C328: AD 15 D0 09 18 8D 15 D0 50
C330: A9 01 8D 8B C2 8D 8C C2 93
C338: A9 00 8D 9D C2 8D 9E C2 BE
C340: A9 E0 8D FB 07 8D FC 07 EC
C348: 60 00 00 AD 00 DC 8D 4A 0B
C350: C3 29 01 D0 03 20 86 C3 7C
C358: AD 4A C3 29 02 D0 03 20 33
C360: BA C3 AD 4A C3 29 04 D0 98
C368: 03 20 E9 C3 AD 4A C3 29 1E
C370: 08 D0 03 20 07 C4 AD 4A 30
C378: C3 29 10 D0 03 20 25 C4 53
C380: A9 00 8D 4A C3 60 AD 49 1D
C388: C3 D0 07 AD 05 D0 C9 70 E1
C390: B0 01 60 C9 D4 B0 FB CE BC
C398: 05 D0 CE 05 D0 A9 E2 8D 2D
C3A0: FA 07 AD 05 D0 C9 B4 D0 75
C3A8: 05 A9 78 8D 1B D0 AD 49 40
C3B0: C3 F0 06 CE 01 D0 CE 01 DB
C3B8: D0 60 AD 05 D0 C9 6E B0 56
C3C0: 01 60 C9 D2 B0 FB EE 05 5F
C3C8: D0 EE 05 D0 A9 E3 8D FA 74
C3D0: 07 AD 05 D0 C9 B8 D0 05 B3
C3D8: A9 7C 8D 1B D0 AD 49 C3 33
C3E0: F0 06 EE 01 D0 EE 01 D0 59
C3E8: 60 AD 04 D0 C9 E8 90 01 10
C3F0: 60 C9 2C 90 FB CE 04 D0 77
C3F8: CE 04 D0 AD 49 C3 F0 06 4E
C400: CE 00 D0 CE 00 D0 60 AD 4D
C408: 04 D0 C9 E6 90 01 60 C9 49
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C410: 2A 90 FB EE 04 D0 EE 04 7D
C418: D0 AD 49 C3 F0 06 EE 00 89
C420: D0 EE 00 D0 60 AD 49 C3 CB
C428: F0 00 20 EB C1 60 A9 09 F9
C430: 8D 05 D4 8D 06 D4 A9 0F B8
C438: 8D 18 D4 A9 21 8D 04 D4 E3
C440: A9 51 8D 00 D4 8D 01 D4 01
C448: A5 A2 69 08 C5 A2 D0 FC 38
C450: A9 20 8D 04 D4 60 00 EE CF
C458: 56 C4 AD 56 C4 C9 19 D0 EF
C460: 08 A9 00 8D 56 C4 EE 44 ED
C468: C0 AD CC 06 C9 39 F0 04 A1
C470: EE CC 06 60 A9 30 8D CC C6
C478: 06 AD CB 06 C9 39 F0 04 F5
C480: EE CB 06 60 A9 30 8D CB D4
C488: 06 AD CA 06 C9 39 F0 04 05
C490: EE CA 06 60 A9 30 8D CA E2
C498: 06 60 AD 6C 07 C9 39 F0 14
C4A0: 04 EE 6C 07 60 A9 30 8D CE
C4A8: 6C 07 AD 6B 07 C9 39 F0 30
C4B0: 04 EE 6B 07 60 A9 30 8D DD
C4B8: 6B 07 AD 6A 07 C9 39 F0 3E
C4C0: 04 EE 6A 07 60 A9 30 8D EC
C4C8: 6A 07 60 AD 0E DC 29 FE 5B
C4D0: 8D 0E DC A5 01 29 FB 85 9A
C4D8: 01 A2 00 BD 00 D0 9D 00 A8
C4E0: 30 BD 00 D1 9D 00 31 E8 58
C4E8: E0 00 D0 EF A5 01 09 04 3E
C4F0: 85 01 AD 0E DC 09 01 8D A7
C4F8: 0E DC A2 00 BD 9D C5 9D 45
C500: 18 31 E8 E0 68 D0 F5 A2 E4
C508: 00 BD 05 C6 9D D8 30 BD F5
C510: 25 C6 9D E0 31 E8 E0 20 95
C518: D0 EF A2 00 BD 45 C6 9D E2
C520: D0 31 BD 4D C6 9D D8 31 9B
C528: BD 55 C6 9D 00 30 A9 18 91
C530: 9D F8 30 E8 E0 08 D0 E4 7E
C538: A2 00 BD 5D C6 9D 00 38 92
C540: E8 E0 00 D0 F5 A2 00 BD 31
C548: 5D C7 9D 00 39 E8 E0 40 4E
C550: D0 F5 A2 00 BD 9D C7 9D 7A
C558: 00 D0 E8 E0 2F D0 F5 A2 8B
C560: 00 A9 E0 9D F8 07 E8 E0 52
C568: 08 D0 F6 A9 E2 8D FA 07 54
C570: A9 E4 8D F9 07 A9 02 8D C6
C578: A7 C1 A9 00 8D 3C C1 8D A4
C580: 3B C1 8D 9D C2 8D 9E C2 5A
C588: 8D 49 C3 8D 9B C0 8D 56 F0
C590: C4 A9 01 8D 8B C2 8D 8C F5
C598: C2 8D 44 C0 60 03 0F 3C 9C
C5A0: 3C FC FC FF FF FF FF 2A 01
C5A8: 26 26 2A FF FF F3 F3 33 3A
C5B0: 33 33 33 FF FF C0 C0 C0 8C
C5B8: C0 C3 CC F0 C0 0F 0C 30 07
C5C0: C0 00 00 00 00 F0 30 0C AE
C5C8: 03 00 00 00 00 03 03 03 D4
C5D0: 03 C3 33 0F 03 C0 C0 C0 1F
C5D8: C0 C0 C0 F7 F7 03 03 03 14
C5E0: 03 03 03 DF DF FF FF 2A D3
C5E8: 2A 26 26 FF FF FF FF FF 5F
C5F0: FF FF FF FF FF 57 7D 7D 43
C5F8: 57 7F 7F 7F FF 57 DF DF E5
C600: DF DF DF 57 FF 57 7F 7F 4D
C608: 5F 7F 7F 57 FF D7 7D 7F 92
C610: D7 FD 7D D7 FF 02 0A 08 4F
C618: 28 20 00 00 00 AA 00 00 0B
C620: 00 00 00 00 00 22 80 28 EA
C628: 20 12 A0 AA 4A AA 98 8A BD
C630: 28 28 08 08 20 29 AA 96 1B
C638: AA A0 A0 0A 21 28 08 8A 0A
C640: 81 24 A8 98 80 FF C3 D7 43
C648: D7 D7 D7 C3 FF FF C3 EB 43
C650: EB EB EB C3 FF 0C 0C 18 08
C658: 00 00 00 00 00 00 00 00 58
C660: 00 00 00 00 00 00 00 00 60
C668: 00 00 00 00 00 00 00 00 68
C670: 00 00 00 00 00 00 00 00 70
C678: 00 00 00 00 00 00 00 00 78
C680: 00 02 AA 00 09 A6 80 0A 67
C688: AA 80 00 00 00 00 00 00 B3
C690: 00 00 00 00 00 00 00 00 90
C698: 00 00 00 00 00 00 00 00 98
C6A0: 00 00 00 00 00 00 00 00 A0
C6A8: 00 00 00 00 00 00 00 00 A8
C6B0: 00 00 00 00 00 00 00 00 B0
C6B8: 00 00 00 00 00 80 00 02 3B
C6C0: 80 00 09 80 00 2A 00 00 F4
C6C8: A8 00 02 60 00 02 80 00 56
C6D0: 00 00 00 00 00 00 00 00 D0
C6D8: 00 00 00 00 00 00 00 00 D8
C6E0: 00 3C 00 00 FF 00 02 AA C9
C6E8: 80 00 AA 00 08 28 20 20 84
C6F0: 14 08 25 55 58 05 55 50 8A
C6F8: 01 55 40 01 55 40 03 FF 29
C700: C0 01 55 40 01 55 40 01 EE
C708: 41 40 01 41 40 01 41 40 8E
C710: 01 41 40 01 71 70 03 C3 3C
C718: C0 00 00 00 00 00 00 00 D8
C720: 00 3C 00 00 FF 00 02 69 C7
C728: 80 00 BE 00 00 28 00 00 8F
C730: 14 00 25 55 58 25 55 58 E9
C738: 29 55 68 09 55 60 03 FF E0
C740: C0 01 55 40 01 55 40 01 2F
C748: 41 40 01 41 40 01 41 40 CE
C750: 01 41 40 01 41 40 03 C3 1C
C758: C0 03 03 00 00 00 00 00 1F
C760: 00 00 00 00 00 00 00 00 60
C768: 00 00 00 00 07 83 C0 0F C2
C770: C7 E0 0F C7 E0 0F C7 E0 88
C778: 6F C7 EC 3F C7 F8 0F 83 2F
C780: E0 07 01 C0 03 01 80 03 B1
C788: 01 80 03 01 80 03 01 80 13
C790: 03 01 80 03 01 80 03 01 9D
C798: 80 03 01 80 00 00 00 DC 7A
C7A0: FB 3C 82 F5 6B F5 6B F5 14
C7A8: 6B F5 6B 00 00 00 1B 00 90
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 93 and 94 explain these codes and provide other essential information on entering *Ahoy!* programs. Refer to these pages **before** entering any programs!

```
C7B0: 00 00 1E D8 04 1D 70 00 39
C7B8: 78 1D 00 00 00 00 00 02 50
C7C0: 07 00 04 09 07 0A 0A 07 F6
C7C8: 07 07 07 0A A9 99 20 D2 1E
C7D0: FF A9 93 20 D2 FF A2 00 A3
C7D8: BD 1A C9 9D 00 04 9D 50 0A
C7E0: 04 BD 6A C9 9D 28 04 A9 4A
C7E8: 07 9D 28 D8 E8 E0 28 D0 51
C7F0: E7 A2 00 BD 92 C9 9D 10 43
C7F8: 05 BD 99 C9 9D 38 05 BD B7
C800: A0 C9 9D 40 07 E8 E0 07 20
C808: D0 E9 A2 00 BD A7 C9 9D 32
C810: B1 05 BD AC C9 9D D9 05 77
C818: BD B1 C9 9D 79 06 9D 19 25
C820: 07 BD B6 C9 9D A1 06 E8 93
C828: E0 05 D0 E0 A2 00 A9 07 13
C830: 9D B0 D9 9D D8 D9 A9 02 54
C838: 9D 10 D9 9D 38 D9 A9 05 1E
C840: 9D 78 DA 9D A0 DA A9 04 F7
C848: 9D 19 DB 9D 40 DB A9 01 3F
C850: 9D C8 DA 9D 68 DB A9 03 20
C858: 9D 3E D8 9D 47 D8 E8 E0 94
C860: 07 D0 CB A2 00 A9 30 9D 1E
C868: CA 06 9D 6A 07 E8 E0 03 15
C870: D0 F5 A9 0D 8D 28 D8 8D 0A
C878: 4F D8 A2 00 BD BB C9 9D 24
C880: 6D 05 E8 E0 1A D0 F5 A2 40
C888: 00 A9 2D 9D BC 04 9D E4 40
C890: 04 9D 0C 05 9D 34 05 9D B7
C898: 5C 05 9D 84 05 9D AC 05 70
C8A0: 9D D4 05 9D 94 04 E8 E0 18
C8A8: 03 D0 E0 A2 00 A9 2D 9D 74
C8B0: 9B 07 9D C3 07 A9 0E 9D 11
C8B8: 9B DB 9D C3 DB E8 E0 1A 51
C8C0: D0 EB A2 26 8E 95 05 8E FD
C8C8: 9E 05 E8 8E 96 05 8E 9F AD
C8D0: 05 E8 8E A0 05 8E AA 05 31
C8D8: E8 8E A1 05 8E AB 05 E8 1F
C8E0: 8E BD 05 8E C6 05 E8 8E 04
C8E8: C9 05 8E D3 05 A9 20 8D 76
C8F0: AC 05 8D D4 05 A2 1B 8E 56
C8F8: 0D 05 E8 8E 35 05 A2 2E 8D
C900: 8E BD 04 E8 8E E5 04 A9 5B
C908: 27 8D 5B 05 A2 00 BD EF 6D
C910: C9 9D 00 D4 E8 E0 19 D0 FF
C918: F5 60 3A 3B 3A 3B 3A 3B CE
C920: 3A 3B 3A 3B 3A 3B 3A 3B F5
C928: 3A 3B 3A 3B 3A 3B 3A 3B FD
C930: 3A 3B 3A 3B 3A 3B 3A 3B 06
C938: 3A 3B 3A 3B 3A 3B 3A 3B 0E
C940: 3A 3B 3B 3A 3B 3A 3B 3A 16
C948: 3B 3A 3B 3A 3B 3A 3B 3A 1E
C950: 3B 3A 3B 3A 3B 3A 3B 3A 26
C958: 3B 3A 3B 3A 3B 3A 3B 3A 2E
C960: 3B 3A 3B 3A 3B 3A 3B 3A 36
C968: 3B 3A 3B 20 20 01 08 0F 71
C970: 19 21 20 10 09 05 20 05 0E
C978: 0D 10 0F 12 09 15 0D 20 02
C980: 20 20 0F 10 05 0E 20 32 45
C988: 34 20 08 0F 15 12 13 20 4E
C990: 20 3A 14 0F 04 01 19 00 2C
C998: 13 13 10 05 03 09 01 0C EC
C9A0: 13 0D 01 13 08 05 04 0C F1
C9A8: 05 0D 0F 0E 02 05 12 12 03
C9B0: 19 10 09 05 13 20 13 0F 3D
C9B8: 0C 04 20 23 24 2C 24 2C AC
C9C0: 24 2C 24 2C 24 2C 24 2C 02
C9C8: 24 2C 24 2C 24 2C 24 2C 0A
C9D0: 24 25 2D 2D 2D 23 2C 24 15
C9D8: 2C 24 2C 24 2C 24 2C 24 1A
C9E0: 2C 24 2C 24 2C 24 2C 24 22
C9E8: 2C 24 2C 25 2D 2D 2D 00 12
C9F0: 00 00 00 00 00 00 00 00 F0
C9F8: 00 00 00 00 00 80 00 00 79
CA00: 00 80 00 00 00 00 00 8F 10
CA08: 03 0C 0F 13 05 04 10 12 64
CA10: 05 13 13 20 06 09 12 05 81
CA18: 20 14 0F 20 13 14 01 12 B5
CA20: 14 00 00 34
```

PLANET DUEL

FROM PAGE 34

```
•10 GRAPHIC4,1,0:POKE3072,0                                        LC
•20 COLOR0,7:COLOR4,13:COLOR1,6:COLOR2,1:
 SPRCOLOR 3,11:PUDEF"0":F$="[3"#"].##"                             OO
•30 DIM V(3),D(4),J(3),C(3),M(3),L(3),A(3
 ),H(3),P,A$(16):P=52330                                           IC
•40 J(1)=1:J(3)=2:D(1)=19:D(2)=90:D(3)=-1
 9:D(4)=270                                                        OJ
•50 FORX=1TO12:READA$(X):NEXT:OF$="[RVSOF
 F]":HI$="[RVSON]"                                                 PK
•60 PRINT"[CLEAR][DOWN][DOWN][3" "][BLACK
 ][RVSON][s U][33"[s C]"][s I]"                                    PN
•70 PRINT"[3" "][RVSON][s B][RVSOFF]"TAB(
 37)"[RVSON][s B]"                                                 AE
•80 PRINT"[3" "][RVSON][s B][RVSOFF] [RVS
 ON][c O] [c I][c I] [c *][c I] [RVSOFF]
  [RVSON][sEP][c D][c F][c *][c O][SS][c
 *][RVSOFF] [RVSON] [RVSOFF][c V][RVSON][
 c O] [c P][c P] [c H][c P] [c P] [RVSOFF
 ]  [RVSON][s B]"                                                  EN
•90 PRINT"[3" "][RVSON][s B][RVSOFF]  [RV
 SON] [c U][c U] [RVSOFF][sEP] [RVSON][SS
 ][RVSOFF]  [RVSON][c G][c C][c V] [RVSOF
 F] [RVSON][SS][RVSOFF] [c *][RVSON] [RVS
 OFF]  [RVSON][SS][RVSOFF][s C][c K][3" "
 ][RVSON] [RVSOFF][4" "][RVSON][s B]"                              KD
•100 PRINT"[3" "][RVSON][s B][RVSOFF]  [R
 VSON] [RVSOFF][5" "][RVSON] [RVSOFF] [RV
 SON][c K][c G][RVSOFF]  [RVSON] [RVSOFF]
```

```
 [RVSON] [RVSOFF]  [RVSON] [RVSOFF]  [RV
SON] [RVSOFF][5" "][RVSON] [RVSOFF][3" "
][SS][RVSON][s B]"                      MD
•110 PRINT"[3" "][RVSON][s B][RVSOFF] [RV
SON][c U] [RVSOFF][4" "][RVSON][c U][3"
"][c G][RVSOFF]  [RVSON] [c U] [RVSOFF]
[c D][RVSON] [RVSOFF][c F][RVSON][c U] [
c Y][c Y] [RVSOFF] [c D][RVSON] [RVSOFF]
[c F]  [SS][RVSON][s B]"                BN
•120 PRINT"[3" "][RVSON][s B][RVSOFF]"TAB
(37)"[RVSON][s B]"                      AE
•130 PRINT"[3" "][RVSON][c Q][11"[s C]"][
RVSOFF]D  U  E  L[RVSON][12"[s C]"][c W]
"                                       KI
•140 PRINT"[3" "][RVSON][s B][RVSOFF]"TAB
(37)"[RVSON][s B]"                      AE
•150 PRINT"[3" "][RVSON][s B][YELLOW][4"
"]BY CLEVELAND M. BLAKEMORE[4" "][BLACK]
[s B]"                                  EA
•160 PRINT"[3" "][RVSON][s J][33"[s C]"][
s K]"                                   AL
•170 PRINT"[DOWN]"TAB(5)"A TWO-PLAYER CON
FLICT IN SPACE"                         LF
•180 PRINT"[DOWN]"TAB(10)"PREPARE FOR COM
BAT!!"                                  PA
•190 PRINT"[DOWN]"TAB(5)"PLEASE STAND BY
FOR PLANETFALL"                         KI
•200 FORX=3584TO3903:READA:POKEX,A:NEXT BA
•210 IFPEEK(3072)=1THEN240              JI
•220 A=170:FORX=0TO320STEP3:I=(RND(1)*40)
+5:DRAW 2,X,A TO X+3,170-I:A=170-I:NEXT:
PAINT2,0,160                            GP
•230 COLOR1,15:FORX=.TO99:A=RND(0)*320:B=
RND(1)*130:DRAW1,A,B:NEXT:COLOR3,8:CIRCL
E3,30,30,15:PAINT3,35,35:POKE3072,1     AK
•240 H(1)=100:H(3)=100:FORZ=1TO3STEP2:X=8 PG
•250 SYSP,,14,.,.:PRINTCHR$(27)"@"      FO
•260 A$="CHOOSE WEAPONS":A=1:B=4:C=12:GOS
UB660:L(Z)=I+5:X=X-I                    HL
•270 SYSP,,14,.,.:PRINTCHR$(27)"@"      FO
•280 A$="PICK DEFENSIVE ARMOR":A=5:B=8:GO
SUB660:A(Z)=I:X=X-I:IFX<=0THENC(Z)=1:GOT
O320                                    LA
•290 SYSP,,14,.,.:PRINTCHR$(27)"@"      FO
•300 A$="DECIDE ON SPACECRAFT ENGINE":A=9
:B=A-1+X+(X>3)*(X-4):GOSUB660:C(Z)=I+1:X
=X-I                                    KB
•310 IFXTHENH(Z)=H(Z)+X*10              FF
•320 NEXT                               IA
•330 FORX=0TO24:FORD=1TO50:NEXT:GRAPHIC4,
0,X:NEXT:SYSP,,24,.,.:PRINT"[c 5]SHIP#1
ERGS:[9" "][c 8]SHIP#2 ERGS:[4" "]";    DL
•340 MOVSPR1,100,100:SPRITE1,1,12,,,,.:SP
RITE2,0,2,,,,.:M(1)=1:V(1)=90:PRINT"[c 8
]";:SYSP,,24,33,.:PRINTUSINGF$;H(1);    OB
•350 MOVSPR3,250,170:SPRITE3,1,16,,,,.:SP
RITE4,0,2,,,,.:M(3)=3:V(3)=270:PRINT"[c
5]";:SYSP,,24,12,.:PRINTUSINGF$;H(3);   CL
•360 J=BUMP(1):J=BUMP(1):J=BUMP(2):J=BUMP
(2)                                     BL
•370 REM MAIN LOOP                      PK
•380 Z=1:DO                             GG
•390 A=JOY(J(Z)):IFAAND15THENV(Z)=((AAND1
5)-1)*45:M(Z)=1+(V(Z)>180)*-2:POKE8183+Z
,M(Z)+55                                LI
•400 IFA>127THENSPRITEZ+1,1:MOVSPRZ+1,RSP
POS(Z,.)+D(M(Z)),RSPPOS(Z,1):MOVSPRZ+1,D
(M(Z)+1)#L(Z):SOUNDZ,10000,33,1,300,300,
3                                       LH
•410 MOVSPRZ,V(Z)#C(Z)                  LL
•420 Z=4-Z:J=BUMP(1):LOOPUNTILJ=6ORJ=9ORJ
=5:IF(BUMP(2)AND5)<>5THEN380            LN
•430 IFJ=6THENBEGIN:MOVSPR5,RSPPOS(3,.),R
SPPOS(3,1):MOVSPR3,.#.:SPRITE5,1,2,,,,1:
SOUND2,5000,30,1,0,500,3:FORX=.TO50:NEXT
:SPRITE5,.:H=RND(1)*L(1)*2+1            GG
•440 IFH>A(3)THENH(3)=H(3)-(H-A(3)):PRINT
"[c 8]";:SYSP,,24,33,.:PRINTUSINGF$;H(3)
;:IFH(3)<=.THENJ=1:I=3:GOTO520          GF
•450 GOTO380                            CH
•460 BEND                               BG
•470 IFJ=9THENBEGIN:MOVSPR5,RSPPOS(1,.),R
SPPOS(1,1):MOVSPR1,.#.:SPRITE5,1,2,,,,1:
SOUND2,5000,30,1,0,500,3:FORX=.TO50:NEXT
:SPRITE5,.:H=RND(1)*L(3)*2              HP
•480 IFH>A(1)THENH(1)=H(1)-(H-A(1)):PRINT
"[c 5]";:SYSP,,24,12,.:PRINTUSINGF$;H(1)
;:IFH(1)<=.THENJ=3:I=1:GOTO520          CP
•490 GOTO380                            CH
•500 BEND                               BG
•510 J=0:I=1                            JL
•520 SPRSAV5,A$:SOUND2,5000,500,1,20,500,
3:FORX=1TO8:IFX<>JTHENSPRSAVA$,X:MOVSPRX
,RSPPOS(I,.),RSPPOS(I,1):SPRITEX,1,2,,,,
1:MOVSPRX,(X-1)*45#1                    IH
•530 NEXT                               IA
•540 IFJ=3THENSYSP,,24,.,.:PRINTCHR$(27)"
Q";TAB(8)"STARPILOT TWO WINS!!";:SLEEP8:
CLR:GOTO580                             OM
•550 IFJ=1THENSYSP,,24,.,.:PRINTCHR$(27)"
Q";TAB(8)"STARPILOT ONE WINS!!";:SLEEP8:
CLR:GOTO580                             KI
•560 SYSP,,24,.,.:PRINTCHR$(27)"Q";"  MID
-AIR COLLISION ENDS IN STALEMATE!!";:FOR
X=.TO150:COLOR0,(XAND15)+1:FORA=1TO50:NE
XTA,X:CLR:GOTO580                       MK
•570 END                                IC
•580 PRINTCHR$(147):GRAPHIC0:POKE208,.:PO
KE53248+21,.:RUN20                      DG
•590 REM WEAPONS                        LL
•600 DATA LASER TORPEDOES,PHOTON CHARGES,
PLASMA TRACERS,NUCLEAR MISSILES         MI
•610 REM ARMOR                          BG
•620 DATA CHROMIUM PLATING,DEFLECTOR WEB,
KIRLIAN FIELD,SHRELL SPHERE             CG
•630 REM ENGINES                        IN
```

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```
·640 DATA ATOMICS,ION PROPULSION,TACHYON
 DRIVE,HALYCON OVERTHRUSTER                 DO
·650 REM MENU                               MC
·660 SYS52330,,14,.,.:PRINTTAB(20-LEN(A$)
 /2);A$:PRINT:PRINT                         HH
·670 PRINTTAB(C)"PLAYER #";INT(Z/2+.6);"
 (<[s C][s C]>)":PRINTTAB(C)"$"X*100:I=1    AE
·680 SYSP,,20,C,.:PRINT;HI$;A$(A+I-1)CHR$
 (27)"Q"                                    NJ
·690 FORJ=1TO90:NEXT                        GJ
·700 J=JOY(Z/2+.6):IFJ>127THENSOUND1,2000
 ,10:RETURN:ELSEIFJ<>3ANDJ<>7THEN700        FI
·710 IFJ=3THENI=I+1:IFA+I-1>BTHENI=1        CI
·720 IFJ=7THENI=I-1:IFI<1THEN660            AJ
·730 GOTO680                                CK
·740 DATA000,000,000,000,000,000,000,000    FG
·750 DATA000,064,000,000,096,000,000,112    JL
·760 DATA000,000,120,000,000,124,000,000    JE
·770 DATA127,192,000,060,063,255,255,255    LF
·780 DATA255,255,255,254,063,252,124,063    LN
·790 DATA255,128,056,000,000,048,000,000    HO
·800 DATA032,000,000,000,000,000,000,000    KD
·810 DATA000,000,000,000,000,000,000,000    FG
·820 DATA000,000,000,000,000,000,000,000    FG
·830 DATA000,000,000,000,000,000,000,000    FG
·840 DATA000,000,000,000,000,000,000,000    FG
·850 DATA000,000,000,000,000,000,000,028    FM
·860 DATA000,000,000,000,000,000,000,000    FG
·870 DATA000,000,000,000,000,000,000,000    FG
·880 DATA000,000,000,000,000,000,000,000    FG
·890 DATA000,000,000,000,000,000,000,000    FG
·900 DATA000,000,000,000,000,000,000,000    FG
·910 DATA000,000,000,002,000,000,006,000    PG
·920 DATA000,014,000,000,030,000,000,062    EG
·930 DATA000,003,254,255,252,060,255,255    CD
·940 DATA255,127,255,255,062,063,252,001    EH
·950 DATA255,252,000,000,028,000,000,012    BG
·960 DATA000,000,004,000,000,000,000,000    FK
·970 DATA000,000,000,000,000,000,000,000    FG
·980 DATA000,000,000,000,000,000,000,000    FG
·990 DATA000,000,000,000,000,000,000,000    FG
·1000 DATA000,000,000,000,000,000,000,000   FG
·1010 DATA000,000,000,000,000,000,000,028   FM
·1020 DATA000,000,000,000,000,000,000,000   FG
·1030 DATA000,000,000,000,000,000,000,000   FG
·1040 DATA000,000,000,000,000,000,000,000   FG
·1050 DATA000,000,000,000,000,000,000,000   FG
·1060 DATA048,000,003,003,016,192,000,000   OL
·1070 DATA000,049,003,076,000,032,000,004   PM
·1080 DATA002,016,048,136,003,002,034,000   EP
·1090 DATA016,000,132,000,136,003,194,000   DM
·1100 DATA000,000,000,132,004,136,000,000   LC
·1110 DATA000,140,192,072,000,004,000,019   BM
·1120 DATA000,193,000,048,000,000,000,012   PM
·1130 DATA048,012,192,003,000,000,000,000   IC
```

LAPS
FROM PAGE 63

```
·10 REM     LAPS     BY JC HILTY            HJ
·20 POKE53280,0:POKE53281,0:PRINT"[CLEAR]
 "TAB(18)"[c 7]LAPS"                        EC
·30 PRINTTAB(4)"[4"[DOWN]"]PLEASE WAIT[8"
 ."]READING DATA"                           PG
·40 GOSUB1520                               FJ
·50 PRINT"[CLEAR][GREEN]PLEASE ENTER THE
 NAME OF PLAYER 1[4"."]"                    NC
·60 PRINT"[4"."]UP TO 10 LETTERS"           AF
·70 INPUTA$:IFLEN(A$)>10THEN50              DD
·80 PRINT"[CLEAR][WHITE]PLEASE ENTER THE
 NAME OF PLAYER 2[4"."]"                    GO
·90 PRINT"[4"."]UP TO 10 LETTERS"           AF
·100 INPUTB$:IFLEN(B$)>10THEN80             FK
·110 GOSUB1290                              FP
·120 D=PEEK(V+30)                           FI
·130 GOSUB1150                              FK
·140 SYS850,23,8:PRINT"[YELLOW]PRESS FIRE
 TO START[4"."]"                            GO
·150 POKE49522,1:POKE49523,8:POKE49524,30
 :POKE49525,23:POKE49526,23                 DO
·160 SYS49152                               KF
·170 SYS828:IFST=0THENFORT=0TO88:NEXT:GOT
 O160                                       EG
·180 IF(PEEK(3)AND16)>0THEN200              GP
·190 FORT=0TO50:NEXT:GOTO160                AO
·200 SYS850,23,8:PRINT"[23" "]"             JL
·210 GOSUB1260                              FK
·220 POKE2040,195:POKE2042,197:LP=0         MP
·230 POKEV+37,1:POKEV+38,2:SYS828:IFST=0T
 HEN290                                     FK
·240 IFPEEK(3)=1THENMP=MP+5:IFMP>300THENM
 P=300                                      LD
·250 IFPEEK(3)=2THENMP=MP-5:IFMP<50THENMP
 =50                                        LC
·260 IFPEEK(3)=4THENX1=X1-6                 OG
·270 IFPEEK(3)=8THENX1=X1+6                 CP
·280 POKEV+8,X1:SYS850,1,9:PRINT"[3" "]":
 SYS850,1,8:PRINT"[YELLOW]"MP               IA
·290 POKEV+37,2:POKEV+38,1:TM=TM+INT(600/
 MP)                                        IN
·300 LP=LP+1:IFLP=100THEN390                OP
·310 IFMP>250THENPOKE2045,194:POKEV+11,14
 2:GOTO340                                  FA
·320 IFMP>150THENPOKE2045,193:POKEV+11,12
 2:GOTO340                                  LE
·330 POKE2045,192:POKEV+11,114:GOTO340      BA
·340 Y1=Y1+1:IFY1>130THENPOKE2046,194       DN
·350 IFY1>150THENY1=110:POKE2046,192:GOTO
 370                                        MP
·360 IFY1<130ANDY1>122THENPOKE2046,193      BD
·370 POKEV+13,Y1:IFPEEK(V+30)AND16THENGOS
```

```
UB1070                                          MI
·380 GOTO230                                    CF
·390 IFE=0THEN410                               PH
·400 GOTO770                                    CK
·410 POKE49522,2:POKE49523,0:POKE49524,38
 :POKE49525,3:POKE49526,7:POKE2040,199          CL
·420 LP=0                                       ID
·430 POKEV+37,1:POKEV+38,2:SYS828:IFST=0T
 HEN480                                         FH
·440 IFPEEK(3)=1THENMP=MP+5:IFMP>300THENM
 P=300                                          LD
·450 IFPEEK(3)=2THENMP=MP-5:IFMP<50THENMP
 =50                                            LC
·460 IFPEEK(3)=4THENX1=X1-6                     OG
·470 IFPEEK(3)=8THENX1=X1+6                     CP
·480 IFMP>250THENPOKE2045,194:POKEV+11,13
 8:X1=X1+10:GOTO510                             BI
·490 IFMP>150THENPOKE2045,193:POKEV+11,12
 2:X1=X1+7:GOTO510                              HE
·500 POKE2045,192:POKEV+11,114:X1=X1+4          OG
·510 Y1=Y1+1:IFY1>130THENPOKE2046,194           DN
·520 IFY1>150THENY1=110:POKE2046,192:GOTO
 540                                            MM
·530 IFY1<130ANDY1>122THENPOKE2046,193          BD
·540 POKEV+8,X1:SYS850,1,9:PRINT"[3" "]":
 SYS850,1,8:PRINT"[YELLOW]"MP                   IA
·550 POKEV+37,2:POKEV+38,1:TM=TM+INT(600/
 MP):POKEV+13,Y1                                GK
·560 SYS49152:LP=LP+1:IFLP=60THEN590            IC
·570 IFPEEK(V+30)AND16THENGOSUB1070             BJ
·580 GOTO430                                    CH
·590 POKE49522,1:POKE49523,0:POKE49524,38
 :POKE49525,3:POKE49526,7:POKE2040,195          KO
·600 LP=0:POKE2042,200                          OP
·610 POKEV+37,1:POKEV+38,2:SYS828:IFST=0T
 HEN660                                         FP
·620 IFPEEK(3)=1THENMP=MP+5:IFMP>300THENM
 P=300                                          LD
·630 IFPEEK(3)=2THENMP=MP-5:IFMP<50THENMP
 =50                                            LC
·640 IFPEEK(3)=4THENX1=X1-6                     OG
·650 IFPEEK(3)=8THENX1=X1+6                     CP
·660 IFMP>250THENPOKE2045,194:POKEV+11,13
 8:X1=X1-10:GOTO690                             CG
·670 IFMP>150THENPOKE2045,193:POKEV+11,12
 2:X1=X1-7:GOTO690                              IC
·680 POKE2045,192:POKEV+11,114:X1=X1-4          OF
·690 Y1=Y1+1:IFY1>130THENPOKE2046,194           DN
·700 IFY1>150THENY1=110:POKE2046,192:GOTO
 720                                            JI
·710 IFY1<130ANDY1>122THENPOKE2046,193          BD
·720 POKEV+8,X1:SYS850,1,9:PRINT"[3" "]":
 SYS850,1,8:PRINT"[YELLOW]"MP                   IA
·730 POKEV+37,2:POKEV+38,1:TM=TM+INT(600/
 MP):POKEV+13,Y1                                GK
·740 SYS49152:LP=LP+1:IFLP=60THENE=1:GOTO
 220                                            BL
·750 IFPEEK(V+30)AND16THENGOSUB1070             BJ
·760 GOTO610                                    CD
·770 L(Z)=TM/10:POKES+4,128                     BK
·780 ONZGOTO860,870,880,890,900,910             EL
·790 LP=0:E=0:Z=Z+1:MP=50:TM=0                  NF
·800 SYS850,1,9:PRINT"[3" "]":SYS850,1,8:
 PRINT"[YELLOW]"MP                              DA
·810 IFC$=A$THENC$=B$:GOTO830                   IL
·820 C$=A$                                      IA
·830 SYS850,1,27:PRINT"[10" "]":SYS850,1,
 27:PRINTC$                                     MJ
·840 X1=164:POKEV+8,X1:POKE2045,192:POKEV
 +11,114:POKE2046,192:Y1=114:POKEV+13,Y1        AM
·850 D=PEEK(V+30):GOTO130                       KL
·860 SYS850,18,9:PRINT"[YELLOW]"L(Z):GOTO
 790                                            GN
·870 SYS850,18,29:PRINT"[YELLOW]"L(Z):GOT
 0790                                           GH
·880 SYS850,19,9:PRINT"[YELLOW]"L(Z):GOTO
 790                                            HE
·890 SYS850,19,29:PRINT"[YELLOW]"L(Z):GOT
 0790                                           JM
·900 SYS850,20,9:PRINT"[YELLOW]"L(Z):GOTO
 790                                            HA
·910 SYS850,20,29:PRINT"[YELLOW]"L(Z)           PB
·920 L(7)=INT((L(1)+L(3)+L(5))/3):SYS850,
 21,9:PRINT"[YELLOW]"L(7)                       GJ
·930 L(8)=INT((L(2)+L(4)+L(6))/3):SYS850,
 21,29:PRINT"[YELLOW]"L(8)                      JK
·940 IFL(7)>L(8)THENW$=B$:GOTO970               JC
·950 IFL(8)>L(7)THENW$=A$:GOTO970               JB
·960 IFL(7)=L(8)THENW$="TIE"                    AB
·970 SYS850,23,16:PRINT"[c 3]"W$                JD
·980 FORT=0TO6000:NEXT:POKEV+21,0               MM
·990 PRINT"[CLEAR][8"[DOWN]"]"A$"  "L(7):
 PRINT                                          NH
·1000 PRINTB$"  "L(8):PRINT                     EB
·1010 PRINT"THE WINNER WAS "W$:PRINT:PRIN
 T                                              HJ
·1020 PRINT"[YELLOW]PLAY AGAIN  Y OR N"         DG
·1030 GETJK$:IFJK$<>""THEN1030                  PD
·1040 GETR$:IFR$=""THEN1040                     LJ
·1050 IFR$="Y"THEN50                            FG
·1060 END                                       IC
·1070 FORX=0TO24:POKES+X,0:NEXT:POKES+24,
 15:POKES+5,8:POKES+6,255:POKES+4,85            AH
·1080 F1=100:F2=230:FORX=1TO80:POKES,F1:P
 OKE2044,201:POKES+15,F2:POKE2044,194           LK
·1090 F2=F2-2:F1=F1*.99:NEXT:POKES+6,15         NI
·1100 Y1=114:POKEV+13,Y1:X1=164:POKEV+8,X
 1:POKE2045,192:POKE2046,192:POKEV+11,114       AE
·1110 TM=TM+20:MP=50:SYS850,1,9:PRINT"[3"
 "]":SYS850,1,8:PRINT"[YELLOW]"MP               LJ
·1120 D=PEEK(V+30)                              FI
·1130 GOSUB1260:RETURN                          CP
·1140 REM    INITIAL FANFARE                    IJ
·1150 FORX=0TO24:POKES+X,0:NEXT                 PM
·1160 RESTORE                                   IO
·1170 POKES+5,85:POKES+6,85:POKES+12,85:P
```

```
OKES+13,85:POKES+24,15:POKES+4,33               LA
·1180 POKES+11,17                               KH
·1190 FORX=0TO5                                 JO
·1200 READH1,N1,H2,N2:POKES+1,H1:POKES,N1
:POKES+8,H2:POKES+7,N2                          AB
·1210 IFH1=50THENFORT=0TO200:NEXT               LP
·1220 FORT=0TO100:NEXT:NEXT                     ID
·1230 FORX=0TO24:POKES+X,0:NEXT                 PM
·1240 RETURN                                    IM
·1250 REM    CAR SOUND                          PM
·1260 FORX=0TO24:POKES+X,0:NEXT                 PM
·1270 POKES,251:POKES+1,05:POKES+5,129:PO
KES+6,65:POKES+24,15:POKES+4,129:RETURN         MJ
·1280 REM    INITIALIZE PLAYING SCREEN          HM
·1290 MP=50:V=53248:S=54272:TM=0:X1=164:L
P=0:E=0:Z=1:C$=A$:Y1=114                        HD
·1300 PRINT"[CLEAR]":POKE53280,0:POKE5328
1,0                                             OD
·1310 PRINTTAB(4)"[WHITE]MPH[WHITE]"MP;TA
B(21)"[WHITE]RACER [CYAN]"A$:PRINT              PH
·1320 PRINTTAB(7)"[RVSON][c 7] "TAB(19)"
":PRINTTAB(7)"[RVSON] "TAB(19)" "TAB(31)
" "                                             BG
·1330 PRINTTAB(2)"[RVSON] [RVSOFF][4" "][
RVSON]  [RVSOFF][4" "][RVSON] [RVSOFF][5
" "][RVSON] [RVSOFF][5" "][RVSON] [RVSOF
F][5" "][RVSON] "                               IO
·1340 PRINTTAB(2)"[RVSON] [RVSOFF] [RVSON
] [RVSOFF]  [RVSON]  [RVSOFF][4" "][RVSO
N] [RVSOFF]  [RVSON] [RVSOFF] [RVSON][3"
 "][RVSOFF]  [RVSON] [RVSOFF] [RVSON] [R
VSOFF][3" "][RVSON] [RVSOFF] [RVSON]  [R
VSOFF][3" "][RVSON] "                           JH
·1350 PRINT"[RVSON][39" "]"                     GO
·1360 PRINT"[7"[DOWN]"][CYAN][RVSON][39"
"]"                                             GD
·1370 PRINTTAB(3)"[RVSON][c 7]"A$;TAB(18)
"[CYAN]  "TAB(23)"[c 7]"B$                      AM
·1380 PRINTTAB(18)"[CYAN][RVSON]  ":PRINT
TAB(3)"[c 7]LAP 1"TAB(18)"[RVSON][CYAN]
 [RVSOFF]"TAB(23)"[c 7]LAP 1"                   CP
·1390 PRINTTAB(3)"[c 7]LAP 2"TAB(18)"[RVS
ON][CYAN]  [RVSOFF]"TAB(23)"[c 7]LAP 2"         OP
·1400 PRINTTAB(3)"[c 7]LAP 3"TAB(18)"[RVS
ON][CYAN]  [RVSOFF]"TAB(23)"[c 7]LAP 3"         BB
·1410 PRINT" [c 7]AVERAGE"TAB(18)"[RVSON]
[CYAN]  [RVSOFF] [c 7]AVERAGE"                  GN
·1420 PRINTTAB(15)"[RVSON][CYAN] WINNER "       PC
·1430 POKEV+37,1:POKEV+38,2:POKEV+43,2:PO
KEV+44,5                                        FL
·1440 POKE2040,195:POKE2041,196:POKE2042,
197:POKE2043,198:POKE2044,194                   EF
·1450 POKE2045,192:POKEV+28,15:POKEV+29,1
27:POKEV+23,15                                  GN
·1460 POKEV,104:POKEV+1,114:POKEV+2,56:PO
KEV+3,138                                       CP
·1470 POKEV+4,200:POKEV+5,114:POKEV+6,248
:POKEV+7,138                                    ND
·1480 POKEV+8,164:POKEV+9,146:POKEV+10,14
0:POKEV+11,114                                  IL
·1490 POKE2046,192:POKEV+45,7:POKEV+12,15
7:POKEV+13,110                                  BG
·1500 POKEV+21,127:D=PEEK(V+30)                 FF
·1510 RETURN                                    IM
·1520 FORX=0TO5:READH1,N1,H2,N2:NEXT            ND
·1530 FORX=49152TO49528:READA:POKEX,A:NEX
T                                               LP
·1540 FORX=12288TO12926:READA:POKEX,A:NEX
T                                               IH
·1550 FORX=828TO848:READA:POKEX,A:NEXT          PA
·1560 FORX=850TO865:READA:POKEX,A:NEXT          MM
·1570 DIML(8)                                   GD
·1580 RETURN                                    IM
·1590 REM    FANFARE DATA                       KH
·1600 DATA 25,30,18,209,33,135,25,30,42,6
2,31,165,50,60,37,162,42,62,31,165              FA
·1610 DATA 50,60,37,162                         OJ
·1620 REM SCROLL DATA                           GJ
·1630 DATA 174,114,193,224,3,144,3,76,117
,192,188,114,193,140,121,193,174                GI
·1640 DATA 118,193,232,202,32,30,193,172,
121,193,173,119,193,201,2,208,10                EL
·1650 DATA 169,32,72,173,33,208,72,76,50,
192,177,90,72,177,92,72,204                     CN
·1660 DATA 116,193,240,20,200,177,90,72,1
77,92,136,145,92,104,145,90,200                 CI
·1670 DATA 204,116,193,208,238,240,18,136
,177,90,72,177,92,200,145,92,104                AK
·1680 DATA 145,90,136,204,115,193,208,238
,173,119,193,201,0,208,5,104,104                KD
·1690 DATA 76,111,192,104,145,92,104,145,
90,236,117,193,208,160,96,172,116               OJ
·1700 DATA 193,200,189,114,193,170,32,30,
193,173,120,193,201,2,208,19,136                OP
·1710 DATA 169,32,153,122,193,173,33,208,
153,162,193,204,115,193,208,239,240             KB
·1720 DATA 16,136,177,90,153,122,193,177,
92,153,162,193,204,115,193,208,240              CE
·1730 DATA 236,117,193,240,37,202,32,30,1
93,172,116,193,200,136,177,90,72                MG
·1740 DATA 177,92,32,48,193,145,92,104,14
5,90,32,56,193,204,115,193,208                  HJ
·1750 DATA 234,236,117,193,208,221,240,46
,202,206,118,193,232,32,30,193,172              GF
·1760 DATA 116,193,200,136,32,48,193,177,
90,72,177,92,32,56,193,145,92                   IC
·1770 DATA 104,145,90,204,115,193,208,234
,236,118,193,208,221,238,118,193,232            AL
·1780 DATA 32,30,193,173,120,193,201,0,24
0,20,172,115,193,136,200,185,162                DK
·1790 DATA 193,145,92,185,122,193,145,90,
204,116,193,208,240,96,189,89,193               EP
·1800 DATA 133,91,24,105,212,133,93,189,6
4,193,133,90,133,92,96,72,152                   IA
·1810 DATA 24,105,40,168,104,96,72,152,56
,233,40,168,104,96,0,40,80                      LL
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 93 and 94 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

```
·1820 DATA 120,160,200,240,24,64,104,144,
 184,224,8,48,88,128,168,208,248          LK
·1830 DATA 32,72,112,152,192,4,4,4,4,4,4,
 4,5,5,5,5,5                              JG
·1840 DATA 5,6,6,6,6,6,6,6,7,7,7,7,7,2,0,
 29,0,21,1,1                              LD
·1850 REM    SPRITE DATA                  IB
·1860 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
 0,0,0,0,84,0,0,124,0,0,16,0,0,186,0      JK
·1870 DATA 0,255,0,0,146,0,0,0,0,0,0,0,0,
 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0    KB
·1880 DATA 0,0                            BC
·1890 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
 0,0,0,0,16,0,0,186,0,0,255,0,0,146,0     GP
·1900 DATA 0,56,0,0,124,0,3,108,128,3,41,
 128,3,255,128,3,57,128,3,17,128          EP
·1910 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0      JH
·1920 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
 0,0,0,6,24,96,6,126,96,7,255,224         NK
·1930 DATA 6,126,96,6,24,96,0,60,0,248,12
 6,31,248,231,31,248,195,31               IO
·1940 DATA 255,195,255,255,195,255,248,25
 5,31,248,126,31,248,24,31,248,0,31,0     LJ
·1950 DATA 0,0,0,0,0,3,0,0,4,0,0,48,0,0,2
 40,0,1,64,0,5,0,0,60,0,0,240,0,1,64,0    KM
·1960 DATA 5,64,0,21,0,0,252,0,0,240,0,0,
 192,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0    KN
·1970 DATA 0,0,0,0                        NG
·1980 DATA 0,0,0,0,0,3,0,0,15,0,0,21,0,0,
 85,0,1,84,0,15,240,0,63,192,0,255,0      JE
·1990 DATA 3,252,0,5,80,0,21,64,0,85,64,0
 ,85,0,0,84,0,0,0,0,0,0,0,0,0,0,0,0,0,0   EH
·2000 DATA 0,0,0,0,0,0,0                  PD
·2010 DATA 0,0,0,192,0,0,16,0,0,12,0,0,15
 ,0,0,1,64,0,0,80,0,0,60,0,0,15,0         EP
·2020 DATA 0,1,64,0,1,80,0,0,84,0,0,63,0,
 0,15,0,0,3,0,0,0,0,0,0,0,0,0,0,0,0,0,0   BD
·2030 DATA 0,0,0,0,0                      DH
·2040 DATA0,0,0,192,0,0,240,0,0,84,0,0,85
 ,0,0,21,64,0,15,240,0,3,252,0,0,255,0    BB
·2050 DATA 0,63,192,0,5,80,0,1,84,0,1,85,
 0,0,85,0,0,21,0,0,0,0,0,0,0,0,0,0,0,0    GL
·2060 DATA 0,0,0,0,0,0,0                  PD
·2070 DATA 0,0,0,192,0,0,16,0,0,12,0,0,12
 ,0,0,1,64,0,0,192,0,0,192,0,0,192,0      BD
·2080 DATA 1,64,0,5,64,0,21,0,0,252,0,0,2
 40,0,0,192,0,0,0,0,0,0,0,0,0,0,0,0,0,0   AH
·2090 DATA 0,0,0,0,0,0,0                  PD
·2100 DATA 0,0,0,0,0,3,0,0,4,0,0,48,0,0,4
 8,0,0,64,0,3,0,0,3,0,0,3,0,0,1,64        EJ
·2110 DATA 0,1,80,0,0,84,0,0,63,0,0,15,0,
 0,3,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0    IH
·2120 DATA 0,0,0,0                        NG
·2130 DATA 0,0,0,76,1,0,00,128,4,32,4,32,
 0,48,0,8,0,0,0,32,48,80,0,130,3,12,0     KI
·2140 DATA 0,0,4,32,0,128,0,36,0,0,0,192,
 201,0,4,0,0,0,19,32,192,0,4,0,32,0,1     GH
·2150 DATA 4,192,0,0,4,8,0,0,0            NC
·2160 REM    JOYSTICK DATA                CP
·2170 DATA 173,0,220,41,31,73,31,133,3,17
 3,1,220,73,255,133,2,5,3,133,144,96      KJ
·2180 REM                                 JD
·2190 DATA 32,155,183,138,72,32,155,183,1
 04,170,164,101,24,76,240,255             HG
```

FRACTALS
FROM PAGE 20

FRACTAL MAKER

```
·1 REM ================================== OM
·2 REM                                    JD
·3 REM        FRACTAL   MAKER             BM
·4 REM              C-128                 KC
·5 REM                                    JD
·6 REM       RUPERT REPORT #40            OH
·7 REM                                    JD
·8 REM ================================== OM
·9 GRAPHIC 1,1   :REM FIX BASIC BUG       GK
·10 GOSUB 8000   :REM DEFINE ALL VARIABLES FH
·20 MEM=FRE(1)   :REM FREE VARIABLE MEMORY MA
·30 BP=10        :REM BYTES PER POINT     KH
·40 PI=3.14159265 : P2=2*PI : P0=PI/2     MM
·50 DEF FNR(X)=INT(X+.5)   :REM ROUND OFF KO
·90 REM ================================= IO
·100 GOSUB 9000 :REM MENU                 FN
·200 GOSUB 2000   :REM INITIALIZE         PG
·300 GOSUB 3000   :REM WINDOW SET-UP      NE
·400 GOSUB 4000   :REM GET GENERATOR      HM
·500 GOSUB 5000   :REM DRAW ALL LEVELS    GG
·600 GOSUB 6000   :REM SHOW MIN/MAX VALUES GH
·700 PRINT"PRESS ANY KEY FOR MENU"        PF
·710 GETKEY K$                            AM
·800 RUN          :REM BACK TO MENU       CM
·999 END :=============================== IK
·2000 REM ======= INITIALIZATION ======== PA
·2010 READ N,R     :REM   # LINE SEGMENTS,
 # HORIZONTAL DIVISIONS                   HN
·2020 ML=FNR(LOG(MEM/BP)/LOG(N)) :REM MAX
 LEVEL                                    AO
·2030 NP=FNR(N[UPARROW]ML)         :REM # P
OINTS                                     PH
·2040 SS=NP/N             :REM SAVE INCR. HB
·2045 IF NP>6000 THEN ML=ML-1 : GOTO 2030 ON
·2050 DIM X(NP),Y(NP)     :REM POINTS     KC
·2060 DIM DX(N),DY(N)     :REM DELTAS     JA
·2070 RETURN                              IM
·3000 REM ======= SET UP WINDOW ========= CH
·3010 GRAPHIC 2,1,23    :REM SPLIT SCREEN EA
·3020 :REM  VIEWPORT COORDINATES          JC
·3030 VL=0 : VR=320       :REM LEFT,RIGHT CI
```

```
·3040 VB=0 : VT=200      :REM BOTTOM,TOP  MK
·3050 :REM  WORLD COORDINATES             HG
·3060 READ WL,WR,WB,WT :REM WORLD MIN,MAX CG
·3070 WL=WL/R : WR=WR/R                   CD
·3080 WB=WB/R : WT=WT/R                   FD
·3090 A=(VR-VL)/(WR-WL)                   CM
·3100 B=VL-A*WL                           OD
·3110 C=(VT-VB)/(WT-WB)                   FK
·3120 D=VB-C*WB                           OD
·3130 XN=1E38 : YN=XN    :REM ACTUAL MIN  MO
·3140 XX=-1E38 : YX=XX   :REM ACTUAL MAX  NM
·3150 RETURN                              IM
·4000 REM ======= GET GENERATOR ========= PG
·4010 REM -- GENERATOR ENDPOINTS --       HH
·4020 X(0)=0 : Y(0)=0                     LH
·4030 X(NP)=1 : Y(NP)=0                   NL
·4040 REM -- GENERATOR MIDPOINTS --       LI
·4050 FOR J=SS TO NP-1 STEP SS            KG
·4060 READ X,Y                            GJ
·4070 X(J)=X/R : Y(J)=Y/R                 GI
·4080 NEXT J                              MM
·4090 REM -- CALCULATE DELTAS --          MB
·4100 FOR J=1 TO N                        JI
·4110 DX(J)=X(J*SS)-X((J-1)*SS)           DL
·4120 DY(J)=Y(J*SS)-Y((J-1)*SS)           CG
·4130 NEXT J                              MM
·4140 RETURN                              IM
·5000 REM ======= DRAW ALL LEVELS ======= JG
·5010 :FOR LEVEL=1 TO ML                  FM
·5020 IS=FNR(N[UPARROW](LEVEL-1))      :RE
 M INIT # SEGS                            FP
·5030 FS=FNR(N[UPARROW]LEVEL)         :REM
  FINAL # SEGS                            DB
·5040 SR=NP/IS       :REM READ INCREMENT  NJ
·5050 SS=NP/FS       :REM WRITE INCREMENT BK
·5060 K$="" : GET K$ :IF K$<>"" THEN 5060 DJ
·5070 SCNCLR 2 : PRINT "#" VS ": LEVEL ="
 LEVEL "OF" ML "; # PTS. =" FS+1          LA
·5080 XL=X(0) : YL=Y(0)  :REM LEFT ENDPT. GC
·5090 X=XL : Y=YL                         JE
·5100 GOSUB 7200         :REM CONVERT     GA
·5110 DRAW 1,XP,YP     :REM INITIAL PT.   ML
·5120 REM  -- STEP THRU EACH SEGMENT  --  BD
·5130 ::FOR SG=SR TO NP STEP SR           HK
·5140 XR=X(SG) : YR=Y(SG)  :REM RT. ENDPT OF
·5150 DX=XR-XL : DY=YR-YL  :REM DELTAS    JB
·5160 L=SQR(DX*DX + DY*DY) :REM SEG LNTH. LP
·5170 GOSUB 7010           :REM GET ANGLE EI
·5180 CS=COS(P2-AN) : SN=SIN(P2-AN)       DB
·5190 NDX=SG-SR            :REM WRITE INDEX CA
·5200 X0=XL : Y0=YL        :REM SEG. ORIGIN GN
·5210 GET K$ : IF K$<>"" THEN GOSUB 7300  AM
·5220 REM -- STEP THRU EACH SUBSEGMENT -- FH
·5230 :::FOR SB=1 TO N-1                  IC
·5240 V=XL+L*DX(SB)                       OM
·5250 W=YL+L*DY(SB)                       OL
·5260 V0=V-X0 : W0=W-Y0    :REM TRANSLATE JE
·5270 X=V0*CS+W0*SN+X0    :REM ACTUAL ... MG
·5280 Y=-V0*SN+W0*CS+Y0   :REM ...COORDS  EJ
·5290 GOSUB 7200    :REM GET SCREEN PTS   PN
·5300 DRAW TO XP,YP                       AL
·5310 GOSUB 7100          :REM SAVE MIN/MAX BI
·5320 NDX=NDX+SS   :REM INCR. WRITE INDEX HH
·5330 X(NDX)=X : Y(NDX)=Y    :REM SAVE PT HC
·5340 XL=V : YL=W        :REM NEXT LEFT PT DP
·5350 :::NEXT SB                          MF
·5360 X=XR : Y=YR                         LI
·5370 GOSUB 7200            :REM CONVERT  GA
·5380 DRAW TO XP,YP      :REM LAST SUBSEG PL
·5390 XL=XR : YL=YR :REM NEXT SEG LEFT PT EK
·5400 ::NEXT SG                           JC
·5410 IF LEVEL<ML THEN PRINT"PRESS ANY KE
 Y FOR -NEXT LEVEL-"                      BP
·5420 IF LEVEL>=ML THEN PRINT"PRESS ANY K
 EY FOR ACTUAL SCREEN SIZES"              PJ
·5430 GETKEY K$                           AM
·5440 :NEXT LEVEL                         EN
·5450 RETURN                              IM
·6000 REM ======= DISPLAY MIN/MAX ======= MC
·6010 GRAPHIC 0,1                         GK
·6020 PRINT "#" VS ": XMIN,XMAX,YMIN,YMAX
 :"                                       GA
·6030 FM$="[3"#"].##[3" "][3"#"].##[3" "]
 [3"#"].##[3" "][3"#"].##"                GH
·6040 PRINT USING FM$;XN*R,XX*R,YN*R,YX*R FA
·6050 RETURN                              IM
·7000 REM ----- SUBROUTINES -----         AC
·7010 REM -- FIND SEGMENT ANGLE --        ME
·7020 IF DX=0 THEN AN=P0-(DY<0)*PI : GOTO
   7060                                   HD
·7030 AN=ATN(DY/DX)                       CI
·7040 IF DX<0 THEN AN=AN+PI : GOTO 7060   JB
·7050 IF DY<0 THEN AN=AN+P2               LG
·7060 RETURN                              IM
·7100 REM -- FIND MIN/MAX VALUES --       BB
·7110 IF X<XN THEN XN=X                   JH
·7120 IF X>XX THEN XX=X                   JN
·7130 IF Y<YN THEN YN=Y                   JF
·7140 IF Y>YX THEN YX=Y                   JL
·7150 RETURN                              IM
·7200 REM -CONVERT X,Y TO SCREEN COORDS - AN
·7210 XP=A*X+B                            IO
·7220 YP=200-C*Y-D                        OI
·7230 IF XP>VR THEN XP=VR                 DC
·7240 IF XP<VL THEN XP=VL                 DA
·7250 IF YP>VT THEN YP=VT                 EK
·7260 IF YP<VB THEN YP=VB                 CI
·7270 RETURN                              IM
·7300 REM --- STOP OR CONTINUE ---        CH
·7310 PRINT "<C>ONTINUE OR <M>ENU?"       OI
·7320 GETKEY K$ : IF K$="M" THEN RUN      NH
·7330 PRINT "#" VS ": LEVEL =" LEVEL "OF"
 ML "; # PTS. =" FS+1                     JC
·7340 RETURN                              IM
·8000 REM ------- DEFINE ALL VARIABLES -- DK
·8010 X=0:Y=0:XL=0:YL=0:XR=0:YR=0:L=0:V=0
```

```
:W=0:V0=0:W0=0:CS=0:SN=0:N=0              NJ
8020 X0=0:Y0=0:XP=0:YP=0:NDX=0:SS=0:SB=0
:XN=0:XX=0:YN=0:YX=0:A=0                  CB
8030 B=0:C=0:D=0:VR=0:VL=0:VT=0:VB=0:DX=
0:DY=0:SG=0:AN=0:PI=0:VS=0                PP
8040 WL=0:WR=0:WT=0:WB=0:J=0:IS=0:FS=0:S
R=0:K$="":LEVEL=0:FM$=""                  NB
8050 RETURN                               IM
9000 REM ======= MENU ================== MB
9010 GRAPHIC 0,1                          GK
9020 PRINT"1. TWIDDLES"                   AD
9030 PRINT"2. ZIG-ZAG"                    EJ
9040 PRINT"3. PYRAMIDS"                   KG
9050 PRINT"4. KITE TAIL"                  PN
9060 PRINT"5. BLUEPRINT"                  AN
9070 PRINT"6. ORTHOGONALITY"              CI
9080 PRINT"7. DIADEM"                     CE
9090 PRINT"8. RORSCHACH"                  DO
9100 PRINT"9. LACE"                       IM
9110 NUMSEL=9   :REM # OF SELECTIONS      CM
9120 PRINT                                JJ
9130 PRINT "SELECT AN ITEM #  OR PRESS
<Q>  TO QUIT"                             KD
9140 GETKEY SS$ : IF SS$="Q" THEN END     FA
9150 VS=VAL(SS$)                          DN
9160 IF VS<1 OR VS>NUMSEL THEN 9130       FJ
9170 DL=10000+VS*100   :REM DATA LINE #   AJ
9180 RESTORE DL        :REM SET READ PTR. CA
9190 RETURN                               IM
9900 REM ==========================       ME
9980 REM  --- DATA STRUCTURE ---          IN
9990 REM -DO NOT CHANGE LINE NUMBERS-     FH
10000 REM                                 JD
10020 DATA N,R [# GENERATOR SEGMENTS,  #
 HORIZONTAL DIVISIONS]                    KC
10040 DATA XMIN, XMAX, YMIN, YMAX [IMAGE
 SIZE: XN, XX, YN, YX]                    FI
10060 DATA X1,Y1, X2,Y2, ... [N-1 GENER-
 ATOR MIDPTS.  OMIT 0,0 AND R,0 ENDPTS.]  HC
10080 REM                                 JD
10100 REM - FRACTAL 1                     AE
10120 DATA 8,4                            BO
10140 DATA 0,4.2,-1.4,1                   LG
10160 DATA 1.2,0, 1.2,.8, 1.8,.8, 1.8,0,
 1,0, 2,-1, 3,-1                          OA
10180 REM                                 JD
10200 REM - FRACTAL 2                     AH
10220 DATA 10,6                           EO
10240 DATA -.2,6.2,-3,2.2                 DN
10260 DATA 1,1, 2,2, 3,1, 4,0, 3,-1, 2,0
, 2,-1, 2,-2, 5,-1                        CJ
10280 REM                                 JD
10300 REM - FRACTAL 3                     AG
10320 DATA 8,4                            BO
10340 DATA 0,4, -.5,1.5                   IO
10360 DATA 1,0, 2,0, 1,1, 2,1, 3,1, 2,0,
 3,0                                      IN
10380 REM                                 JD
10400 REM - FRACTAL 4                     AJ
10420 DATA 7,3                            CC
10440 DATA 0,3,-1.4,1.4                   OH
10460 DATA 1,0, 2,1, 2,0, 1,0, 1,-1, 2,0  MB
10480 REM                                 JD
10500 REM - FRACTAL 5                     AI
10520 DATA 7,3                            CC
10540 DATA -3,3.5,-1.5,4.9                IE
10560 DATA 0,2, 2,2, 2,1, 1,1, 1,0, 2,0   CA
10580 REM                                 JD
10600 REM - FRACTAL 6                     AL
10620 DATA 7,5                            CE
10640 DATA -.5,5,-.8,3                    KP
10660 DATA 1,1, 2,2, 3,2, 4,2, 2,0, 4,0   MH
10680 REM                                 JD
10700 REM - FRACTAL 7                     AK
10720 DATA 9,5                            BO
10740 DATA 0,5,-1.5,1.5                   NH
10760 DATA 1,0, 2,1, 3,1, 4,0, 1,0, 2,-1
, 3,-1, 4,0                               PL
10780 REM                                 JD
10800 REM - FRACTAL 8                     AN
10820 DATA 10,5                           EP
10840 DATA 0,5,-1.4,1.4                   MF
10860 DATA 1,0, 1,1, 2,1, 2,0, 2.5,-1, 3
,0, 3,1, 4,1, 4,0                         HF
10880 REM                                 JD
10900 REM - FRACTAL 9                     AM
10920 DATA 5,3                            BI
10940 DATA 0,3,-.5,2                      DO
10960 DATA 1,0, 1,1, 2,1, 2,0             GO
10980 REM                                 JD
11000 REM == SAVE IMAGE TO DISK  ==       OC
11010 INPUT"SAVE IMAGE WITH WHAT FILENAM
E";FL$                                    LG
11020 GRAPHIC 1                           BB
11040 BSAVE (FL$),P8192 TO P16191         IF
11060 GRAPHIC 0                           AO
11070 PRINT "TO DISPLAY IMAGE, TYPE 'GOT
O 12[3"0"]' "                             DA
11080 END                                 IC
12000 REM == DISPLAY IMAGE FROM DISK ==   DJ
12010 INPUT "DISPLAY WHAT FILE";FL$       DP
12020 GRAPHIC 1,1                         GP
12030 BLOAD (FL$)                         AC
12040 GRAPHIC 0                           AO
12050 END                                 IC
13000 REM === HI-RES DUMP TO EPSON ===    MO
13010 E$=CHR$(27) : N1=200 : N2=0 :A$=""  JA
13020 OPEN 222,4 :PRINT#222,E$"A"CHR$(8)  FB
13030 FOR COL=0 TO 39                     HB
13040 FOR ROW=24 TO 0 STEP -1             MJ
13050 M=8192+8*COL+320*ROW                OD
13060 FOR LNE=7 TO 0 STEP -1              MH
13070 A$=A$+CHR$(PEEK(M+LNE))             IB
13080 NEXT LNE : NEXT ROW                 AJ
13085 FOR DUP=1 TO 2                      DG
13090 PRINT#222,E$"K"CHR$(N1)CHR$(N2)A$;  DO
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 93 and 94 explain these codes and provide other essential information on entering *Ahoy!* programs. Refer to these pages **before** entering any programs!

```
13095 PRINT#222,CHR$(141); : NEXT DUP :
 PRINT#222                                BC
13100 A$="" : NEXT COL                    BJ
13110 PRINT#222 : CLOSE 222 : END         GL
```

EXTENDED BACKGROUND MODE
FROM PAGE 82

```
10 BANK15:SUM=0:FORI=6144TO6466:READJ:PO
 KEI,J:SUM=SUM+J:NEXT:IFSUM<>32280THENPRI
 NT"ERROR IN DATA":END                    IK
20 SYS6144                                HD
6144 DATA 160,5,185,36,25,153,12,3        OG
6152 DATA 136,16,247,169,0,141,67,25      DM
6160 DATA 96,133,2,160,42,169,25,32       JI
6168 DATA 226,67,144,7,105,166,162,0      HF
6176 DATA 24,144,3,56,165,2,76,33         PG
6184 DATA 67,201,43,144,4,56,76,205       HI
6192 DATA 81,56,233,39,170,160,255,202    FM
6200 DATA 48,8,200,185,42,25,16,250       FG
6208 DATA 48,245,200,185,42,25,48,6       KN
6216 DATA 32,12,86,76,66,24,41,127        GJ
6224 DATA 76,46,81,201,43,176,16,201      KC
6232 DATA 39,240,44,201,40,240,12,201     OF
6240 DATA 41,240,62,201,42,240,121,56     BJ
6248 DATA 76,169,75,169,255,133,216,169   KG
6256 DATA 0,141,0,255,169,91,141,17       AP
6264 DATA 208,169,253,141,38,3,169,24     JG
6272 DATA 141,39,3,32,128,3,96,169        FK
6280 DATA 0,133,216,141,0,255,169,27      EH
6288 DATA 141,17,208,169,121,141,38,3     JC
6296 DATA 169,239,141,39,3,32,128,3       LN
6304 DATA 96,32,128,3,240,84,160,0        CO
6312 DATA 140,68,25,172,68,25,192,4       HI
6320 DATA 176,72,32,244,135,72,169,0      JE
6328 DATA 141,0,255,202,48,60,138,172     PA
6336 DATA 68,25,153,33,208,200,140,68     CB
6344 DATA 25,104,201,0,240,14,201,58      DM
6352 DATA 240,10,201,44,208,36,32,128     BB
6360 DATA 3,76,171,24,32,134,3,96         FC
6368 DATA 32,128,3,240,21,201,49,144      JD
6376 DATA 17,201,53,176,13,41,3,168       KJ
6384 DATA 185,63,25,141,67,25,32,128      IE
6392 DATA 3,96,76,108,121,201,32,144      EJ
6400 DATA 32,201,128,144,4,201,160,144    EM
6408 DATA 24,72,173,67,25,240,17,16       IE
6416 DATA 11,169,128,133,243,173,67,25    KN
6424 DATA 41,1,240,4,104,9,128,72         MC
6432 DATA 104,76,121,239,17,24,41,24      JD
6440 DATA 83,24,69,88,84,79,70,198        BI
6448 DATA 69,88,84,79,206,69,88,84        JH
6456 DATA 67,79,204,69,88,212,0,129       BC
6464 DATA 0,1,128                         NA
```

LIST FORMATTER
FROM PAGE 85

```
100 REM  LIST FORMATTER --SHAWN K. SMITH ED
110 S=5555:REM RELOCATABLE PROGRAM - 'S' BK
120 PRINT:PRINT"[RVSON][CLEAR][DOWN]LIST
 FORMATTER ";                             CO
130 REM  LIST FORMATTER ML CODE 64-BYTES AK
140 DATA 173,007,003,201,028,144,006,169 FJ
150 DATA 203,162,021,208,004,169,081,162 EP
160 DATA 081,141,006,003,142,007,003,096 LA
170 DATA 008,201,058,208,026,036,017,048 BN
180 DATA 022,169,013,032,012,086,162,000 MN
190 DATA 189,000,001,240,008,169,032,032 LL
200 DATA 012,086,232,208,243,169,058,201 CP
210 DATA 143,208,002,133,243,040,234,076 PO
220 REM  POKE ML STARTING AT ADDR. 'S'   OI
230 FORD=STOS+63:READY:POKED,Y:T=T+Y:NEX
 T:T=T-6277:REMARKS ARE HIGHLIGHTED!!!    AK
240 REM  CHECK ML CODE FOR ERROR          DL
250 IF T THEN BEGIN: PRINT :PRINT         FB
260 PRINT"[RVSON]? CHECKSUM ERROR IN DAT
 A ";                                     CJ
270 PRINT"LINES 140-210":END:BEND         OK
280 REM  HANDLE PROGRAM RELOCATION        IM
290 L=PEEK(774):POKED,L:POKES+14,L        LH
300 H=PEEK(775):POKED+1,H:POKES+16,H      FM
310 M=S+24:L%=M/256                       GH
320 POKES+10,L%:POKES+8,M-256*L%          DC
330 SYS(S):PRINT"ENGAGED!":LIST230        AC
340 PRINT"[RVSON]DIS/RE-ENGAGE: SYS"S     PC
350 REM KEY5,"SYS"+STR$(S)+CHR$(13)       EK
360 NEW : SAVE IT BEFORE U RUN IT!!!!!    GN
```

New number for program help:
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(If busy or no answer after three rings, call 212-239-0855)

This new direct line to the *Ahoy!* technical department will provide readers typing in *Ahoy!* programs with the fastest possible assistance.

Continued from page 14

TAX UPDATE

C-64 users can take advantage of the old tax laws one last time with the 1986 version of *Swiftax* ($49.95). The program prompts you through every step of the process and checks alternatives to calculate the lowest possible tax you can pay. Supported are the most common schedules–A,B,C,D,G,SE,W, and Form 2441–the totals from which can be integrated into Forms 1040, 1040A, or 1040EZ. Information can be printed onto tax forms or blank paper.

Timeworks, 312-948-9200 (see address list, page 14).

MIDI SEQUENCER

The *Master Tracks Pro* MIDI sequencer ($299.95), a C-128 update of Passport Designs' *Master Tracks*, supports extended memory for longer songs. The Main Sequencer and Song Mode sections now send and receive MIDI Song Position Pointer, an aid in writing film and TV scores or jingles synced to videotape.

Passport Designs, Inc., 415-726-0280 (see address list, page 14).

WORD WRITER UPGRADE

Word Writer 3 ($49.95) includes all the features of the original C-64 word processor and adds an 85,000 word spell checker, a thesaurus with over 60,000 synonyms and antonyms, an outline processor, 80-column print preview mode, highlighting feature, headers and footers, programmable "Swiftkeys," and GEOS compatibility. The program can be used alone or interfaced with Timeworks' *Data Manager 2, Swiftcalc,* and *Sylvia Porter's Personal Financial Planner.*

Timeworks, 312-948-9200 (see address list, page 14).



Updated to prepare '86 tax return.
READER SERVICE NO. 156

TEACHER'S AID

Lesson Master ($59.95) allows teachers to develop courseware without programming knowledge. The Authoring module includes a character shape editor, sprite shape editor, sprite animator, sound and music editor, and lesson screen editor. The Presenter module lets the student play back a lesson without the little cheat being able to modify it. The File Manager module includes the usual management functions, with the capability to generate lesson summary, student progress, and master file reports.

Small Systems Software, 304-737-2891 (see address list, page 14).

PLUS/4 JOYSTICK CABLES

Interface cables that will connect standard Commodore joysticks to the Plus/4 are available for $10 each, postage included, from R.M. Harris.

R.M. Harris (see address list, page 14).

AMIGA MUSIC PROGRAMS

Two music makers for the Amiga from Electronic Arts:

Instant Music ($49.95) utilizes artificial intelligence by incorporating into the score a musical template that keeps the composer within his chosen key and tempo. The user can make music in real time along with the computer, playing the fourth instrument or voice while the computer plays the other three.

Deluxe Music Construction Set ($99.95) supplies input, editing, and notation tools for easy composing. As the music is played back, the notes of the score flash and an onscreen piano follows along. Instruments and styles can be changed within each staff as desired, and playback speed can be set at 1 to 240 beats per minute. Files can be transferred to the program from *Instant Music.*

Electronic Arts, 415-571-7171 (see address list, page 14).

MODEM

The TCM-1200H Hayes Compatible Modem for the C-64 and 128 ($179.95) features auto-select 300/1200 baud and originate answer modes, 8 LED status indicators, and 8 DIP switches (including an auto-answer disable switch to prevent the modem from answering the phone when not in use). Besides supporting the full set of Hayes AT commands, the modem is Bell 212 and CCITT V.22 compatible. C-64 and C-128 software are included.

Trans Com, Inc., 312-543-9055 (see address list, page 14).

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